Signaling and financial market impact of chile's central bank communication: a content analysis approach

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ABSTRACT   The Central Bank of Chile determines Chile's monetary policy rate and circulates press releases that explain policy decisions after each of its policy meetings. The information contained in these press releases includes current policies, economic outlook, and signals about likely future policies. In this paper, we examine this type of policy communication by using semi-automated content analysis to study the information contained in the releases. Based on this information, we create a quantitative measure that we call the sentiment score index, which we then use to evaluate the effectiveness of the central bank's communication strategy. In this examination, we analyze whether the central bank's communication conveys information regarding the future path of the policy rate. We also study the impact of the monetary policy statement on financial markets. We find that the central bank's communication provides information that helps anticipate the future stance of monetary policy and that causes significant short-term impacts on equity markets.

JEL Codes: E44, E52, E58

Keywords: Central bank, financial market, monetary policy, communication

R esearch related to monetary policy communication has grown rapidly in the last two decades. This increase reflects not only a change in the way policymakers think about announcing their decisions but also the importance of managing expectations and providing insights into the economy. Policymakers have increasingly emphasized the role of communication as a monetary policy tool that can move financial markets, decrease the surprises of monetary policy decisions, and contribute to attaining central banks' macroeconomic objectives of stabilizing inflation and maximizing employment levels. Consequently, there is a growing literature on how central bank policy documents create news, influence expectations, and affect asset prices. Our paper focuses on analyzing the qualitative content of monetary policy statements issued by the Central Bank of Chile (CBC). We use a computational linguistics approach—specifically, semi-automated content

analysis—to evaluate documents published between January 2003 and December 2017. Insofar as these techniques have not been used extensively for the analysis of a small open economy, the main methodological contribution of our paper is to evaluate the communication quality of the monetary policy statements. Using these techniques, we build a sentiment index for each of the policy documents. We then consider the effectiveness of the CBC communication strategy by assessing whether the index conveys meaningful information about the future path of the monetary policy rate (MPR). We also examine how the Chilean stock and bond markets respond to the monetary policy statements.

In our semi-automated content analysis approach, an evaluator creates a computer algorithm based on the observed structure and word choices of policy documents to extract the qualitative information from policy statements. The main advantage of this method is that it is more transparent and less susceptible to the bias of the evaluator(s) than are completely heuristic methods.[1] Moreover, it accounts for the context of the texts more effectively than more automated methods.[2]

Using this approach, we evaluate the information released in monetary policy statements and assess the policy stance. If the information leans toward decreasing inflationary pressures or slowing down growth, we say that it has a hawkish sentiment, in line with the literature. In contrast, if the information conveys fewer risks for inflation or leans toward promoting growth, we say that it has a dovish sentiment. Using this evaluation, we calculate an index that tracks the evolution of the policy sentiments.

We then evaluate the impact of this monetary policy communication measure. Our results show that the sentiment score anticipates the movements of the MPR by about twelve months. This MPR anticipation implies that monetary policy statements could help guide expectations about future changes to the MPR. In addition, we extract the surprise component of this index and study its impact on the Chilean financial market, in conjunction with MPR surprises. Our findings indicate that before the financial crisis,

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1. Lucca and Trebbi (2011) compare the differences between heuristic and automated approaches to evaluate U.S. Federal Reserve statements; they find that the latter seems to be more accurate in depicting the information in these documents.

2. Lucca and Trebbi (2011) use a dictionary method on two measures for the U.S. Federal Reserve's monetary policy statements: Google term associations and news content from the Dow Jones Factiva database. They also employ a heuristic assessment of the Fed's statements based on the authors' assessment. Our work, on the other hand, uses the dictionary method on the Chilean MPR to have a more objective evaluation of the policy documents.

the stock market reacted mainly to surprises in the MPR. After the financial crisis, however, the stock market responded mostly to shocks in the sentiment score index. These results are robust to changes in the definition of the sentiment surprises. We also evaluate the effect on interest rates and find that an MPR surprise is positive, statistically significant, and monotonically decreasing in the length of the instrument from three months to five years, while the information revealed in the sentiment score index appears to have an effect only in the short part of the yield curve before 2008.

When we look at particular episodes, the sentiment score index exhibits some interesting properties. During the latest financial crisis, the index shows that the communication of the CBC was more dovish than it was prior to the recession. In the subsequent recovery period, the sentiment is not as hawkish as before the financial crisis. This may reflect the fact that before the crisis, output growth forecasts were more optimistic, and inflationary pressures were being observed. In contrast, inflation was more subdued in the period after the recession. Another important finding is that the volatility of the sentiment score index has decreased. This finding potentially supports the claim that there has been a learning process in the CBC about how to adequately communicate its monetary policy decisions.

Furthermore, we estimate a vector autoregression (VAR) for a small open economy to examine the relationship between monetary and sentiment surprises and real economic indicators. We find that sentiment surprises do not have a lasting impact on economic indicators. They do, however, significantly increase the predictability of MPR decisions and help align expectations with actual policy.

Our work mainly relates to two strands of literature. First, we follow the literature that studies the effect of monetary policy on financial markets. This research strand includes Cook and Hahn (1989), Kuttner (2001), and Bernanke and Kuttner (2005). The second strand of literature aims to understand central bank communication. In line with this research work, Pescatori (2018) assesses the quality of monetary policy communication by looking at its predictability and effectiveness. He explains that a predictable monetary policy is necessary for credible communication, while its efficacy further guides private sector expectations.

Analyzing monetary policy communication in Chile is insightful given the CBC's international reputation. According to the International Monetary Fund (IMF, 2018), the CBC is a highly transparent central bank with strong credibility.[3] In its report, the IMF highlights the CBC's consistency and points out that its medium-term inflation expectations do not fluctuate much when

the economy is hit by terms-of-trade shocks and other supply shocks. Therefore, the evaluation of CBC monetary policy documents provides more understanding of the effectiveness of credible central bank communications, especially those from small open economies.

The rest of our paper is structured as follows. The next section explores the literature on monetary policy and central bank communication. The paper then discusses monetary policy in Chile and how it has evolved over time. Subsequently, we present the data used in our work; describe the methodology used to analyze the information sentiments in the monetary policy reports and the resulting sentiment index series; discuss our empirical analysis, evaluating the impact on financial markets and examining how the index affects the real economy; and evaluate the robustness of our results. The final section presents some concluding remarks.

Related Literature

As mentioned above, our work falls mainly into two branches of literature. First, it joins the large group of papers evaluating the impact of monetary policy on financial markets. A significant number of these studies examine the short-term effects of the U.S. Federal Reserve's monetary policy announcements on financial markets. In his seminal work, Kuttner (2001) uses data from the federal funds futures market to estimate the impact of monetary policy actions on Treasury bill, note, and bond yields. Consistent with the expectations hypothesis, the results show that only unanticipated changes lead to large and significant responses. Bernanke and Kuttner (2005) add to these discussions by evaluating the impact of the unexpected component of target rate changes on equity prices. They find that the unexpected component causes very large equity market reactions.

Moving away from the United States, we find several studies for Europe. Bohl, Siklos, and Sondermann (2008) find that there is a negative and significant relationship between unexpected European Central Bank (ECB) policy and the European stock market. Pérez-Quiroz and Sicilia (2002) focus on the euro-area yield curve and find that unexpected monetary policy decisions have a limited impact. For the United Kingdom, Bredin and others (2007) find that unexpected changes in monetary policy lead to persistent negative responses in future excess returns in several stock market sectors.

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3. The source of the transparency index is given by Dincer and Eichengreen (2014).

In the case of Chile, several papers analyze the impact of Chilean monetary policy surprises on domestic financial markets. The earliest studies were conducted by Larraín (2005, 2007), who shows that the nominal yield curve reacts in the same direction as monetary surprises, while the response of the real yield curve is subdued. In contrast, Meyer (2006), who uses the answers from Bloomberg surveys to estimate the surprise component of monetary decisions between 2002 and 2006, finds that monetary policy surprises have comparable effects on nominal interest rates.

More recent papers include Ceballos (2014), who estimates the main components of the yield curve and analyzes the effects of macroeconomic news in Chile. He finds that monetary surprises have a positive impact on the level of the yield curve but a negative effect on its slope. Concerning equity markets, Acuña and Pinto (2015) use an event study approach to measure the effect of monetary surprises in a large number of Chilean stock market indexes. Contrary to what is found in the literature, the results of their paper indicate that anticipated changes in monetary policy have adverse effects on stock market returns, while unanticipated changes do not seem to have any impact.

The second branch of the literature related to our work analyzes the communication strategy of central banks. Blinder and others (2008) provide a thorough survey of this literature, based mostly on the experience of advanced economies. The authors document how central banks have moved from complete policy secrecy to evolving transparency. They find that although monetary policy has become more predictable as a result of changes in central bank communication, there is still no consensus on the best practices for a central bank.

This literature has grown with the use of linguistic analysis, whereby a researcher applies a heuristic approach to analyze documents and, using his or her judgment, to quantify the information content. For example, Rosa (2011) examines the impact of monetary policy statements—in conjunction with policy changes—on exchange rates. He finds that the statements have large and significant effects on the valuation of the U.S. dollar against other global currencies. The main issue with this approach is that it is highly subject to evaluator bias.

Recent studies that focus on central bank communication use sophisticated computational linguistics tools to examine the informational content of what the central bank is trying to communicate to the public. For example, Lucca and Trebbi (2011) use a VAR framework to measure the effect of statements by the U.S. Federal Open Market Committee (FOMC) on the macroeconomy.

Hansen and McMahon (2016) add to this VAR analysis by separating the qualitative information in the statements into communication on the state of the economy and forward guidance. They find that forward guidance shocks have stronger effects on real and market variables than current economic conditions.

Some additional studies evaluate the content of policy documents from other central banks. Reeves and Sawicki (2007) study how financial markets react to the minutes and inflation reports published by the Bank of England. The authors find that the publication of these documents affects near-term interest rate expectations in England. Hendry and Madeley (2010) extract information from Bank of Canada statements to find the type of information that affects interest rate market returns and volatility over the 2002–08 period. For Brazil, Carvalho, Cordeiro, and Vargas (2013) use Google search queries to build a time series that measures whether each monetary policy statement is perceived as more hawkish or dovish. They examine the impact of these time series on the term structure of interest rates.

Several papers examine the information provided in Chilean monetary policy statements. Pincheira and Calani (2010) build a communication bias index that shows the most likely future evolution of monetary policy (easing, tightening, or neutral). In contrast to our semi-automated approach, the authors asked participants of the monetary policy meetings to classify the message using prespecified categories. Their work suggests that the calculated sentiment index is an accurate predictor of the future direction of the monetary policy rate (MPR).

García-Herrero, Girardin, and González (2017) examine the impact of Chilean monetary policy shocks while accounting for the monetary policy tone of the statements. Using a heuristic approach, the authors assess whether the Chilean interest rate futures market reacts to the information revealed by the Central Bank of Chile (CBC). The main methodological difference with this paper is that we use a semi-automated approach to analyze the policy meeting statements.[4] This methodological difference allows us to build a richer measure of tone, and the index that we create is a continuous variable that measures the tone of the documents. In contrast, the measure presented by García-Herrero, Girardin, and González (2017) is a discrete index that takes integer values between –2 and 2, going from very dovish to very hawkish.

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4. García-Herrero, Girardin, and González (2017) focus only on some sections of the texts, whereas we consider all discussions relevant to the economic outlook in the meeting statements.

The International Monetary Fund (IMF, 2018) also builds a tone index, similar to our sentiment score index, for a small group of Latin American countries from 2011 to 2017, using latent Dirichlet allocation (LDA). Their results show that the tone is a good predictor of future monetary policy changes. They also find that the tone of press releases explains a significant share of market rate variation.
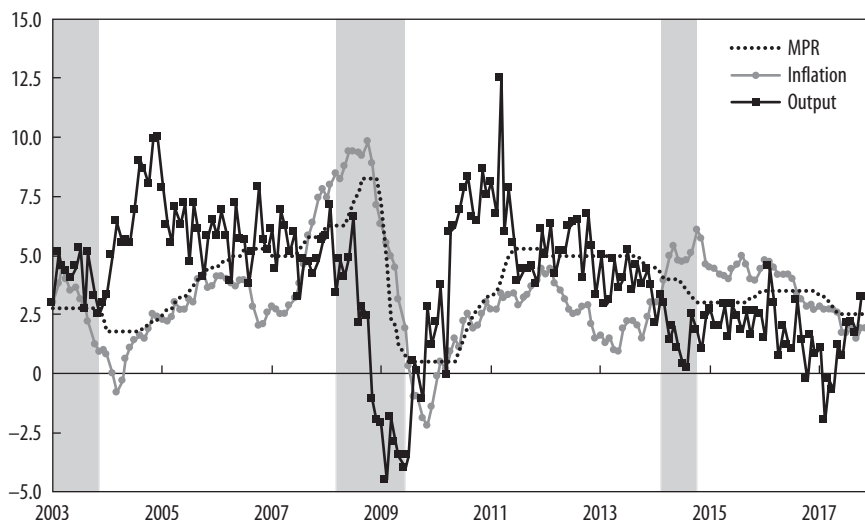
Monetary Policy in Chile

Monetary policy in Chile is currently conducted using an inflation-targeting regime. In 1989, the Basic Constitutional Act of the Central Bank of Chile established that the central bank's objective is to stabilize the value of the currency and to safeguard the normal functioning of the internal and external payment system. This objective thus only requires the CBC to ensure that inflation is low. This requirement contrasts with the dual mandate of the U.S. Federal Reserve, which must also pursue the goal of maximum employment.

The main tool for implementing monetary policy in Chile is the MPR. This rate is decided at monetary policy meetings, whose schedule is announced six months in advance.[5] The decisions made at these meetings are disseminated through public statements, which are generally one-page documents released at 6:00 p.m. on the same day the policy meeting was held. In these documents, the CBC Board explains the reasons behind its decisions. These discussions are mostly based on current inflation forecasts, economic shocks, and international developments that could have an impact on the inflation level in Chile. Although unemployment and growth are not part of the mandate of the CBC, they are referenced in the statements because of their impact on inflation.[6]

Although the monetary policy transition process in Chile was completed in 1999, there have since been important changes in policy implementation. The most notable change is the nominalization of the reference rate and the establishment of an inflation rate target band. Until August 2001, the reference

5. Until 2017, monetary policy meetings were held monthly, usually around the tenth day of each month. Beginning in 2018, the CBC changed the number of monetary policy meetings to eight per year.

6. Longer, more detailed documents (namely, the meeting minutes) are released around two weeks after the policy meeting. For more information on how the CBC conducts monetary policy, see Central Bank of Chile (2007).

F I G U R E 1 .   Chilean Monetary Policy, Inflation, and Output Rates

rate used in conducting monetary policy was an inflation-adjusted interest rate. To decrease inflation inertia, economic indexation was reduced by switching the MPR target to a nominal interest rate level. Also in 2001, the inflation rate target was redefined as a band between 2 percent and 4 percent (and aimed at the center, at 3 percent). This objective was set for an undefined period.[7]

Monetary Policy around the Crisis Period

The situation in Chile before the Great Recession was slightly different from the rest of the world. In particular, Chile was in the midst of an intense drought, which affected food and energy production. Therefore, the Chilean economy was affected not only by the increase in international food and energy prices during the crisis but also by the effects of the drought. As shown in figure 1, inflation rose from 2.8 percent at the beginning of 2005 to 9.9 percent by October 2008. Although the crisis was well on its way to becoming a significant

7. For more information on this transition period and the nominalization of the MPR, see Central Bank of Chile (2000), Morande (2002), and Massad (2003).

event, the CBC Board decided to maintain the MPR at 8.25 percent until inflation subsided. Once inflation began to decrease and economic activity showed signs of weakening, the CBC took several measures to counteract the effects of the financial crisis. These included reducing the MPR from 8.25 percent to 0.50 percent between January and July 2009 and implementing several policies to ease liquidity management in the financial markets, together with complementary monetary policy measures starting in July 2009.[8]

As shown in figure 1, the CBC kept the MPR at a minimum of 0.5 percent for eleven months, starting in July 2009. In 2010, inflation began to show signs of acceleration, so the board increased the MPR to 1 percent in June of that year. This decision was followed by several increases that quickly raised the MPR to 5.25 percent. Finally, the CBC decided to make a sterilized intervention in the foreign exchange rate market in January 2011, with daily asset purchases of U.S. $50 million starting on January 5 and continuing through December 2011. This measure was taken to increase the amount of reserves by U.S. $12 billion in 2011.

Data

The data used for analyzing CBC communications include the monetary policy press releases from January 2003 to December 2007, which are downloaded in English from the CBC web page. In total, the data set covers 180 policy meetings. Data for financial variables are obtained from Bloomberg and also range from January 2003 to December 2017, except for the Chilean interest rate series, which starts in June 2006. Finally, we obtained the expected level of the MPR from the Bloomberg survey and the effective level of MPR directly from the CBC website. Except for the policy statements issued in January, February, and March 2003, all statements were obtained in English. We personally translated the statements that were not available in English, maintaining the style of the statements.[9]

In the literature that examines the effect of monetary policy surprises on financial markets in the United States, research using high-frequency analysis assumes that when the FOMC releases its policy statements, there is no other new information that affects the markets in a given short time interval. This

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8. The financial market liquidity management measures were announced on October 10, December 3, and December 10, 2008.

9. Our findings are robust to the omission of these three statements.

is because the FOMC meeting statements and minutes are released while the markets are still open. The case is different with Chile. The statements are released after the close of the markets, so the effect on prices and returns can only be observed the following morning. It is reasonable to assume that after the release of the statements and before the opening of the markets, there is new information that affects prices and returns.

To account for this possibility, we include a measure that captures relevant events in foreign markets. The measure must satisfy two criteria. First, essential events in international markets must affect the measure before or at the same time as they affect the Chilean stock market. Second, the direction of causality must be that any changes in this measure affect the Chilean stock market, and not the other way around. Otherwise, our estimated effect would not be capturing the influence of international events on Chilean markets. Following these criteria, we use the U.S. stock market return to capture the effect of foreign news on the Chilean stock market. The measures we considered are the S&P 500 Index and the Dow Jones Industrial Average, which are the main broad equity indexes of the United States, as well as the exchange-traded funds (ETFs) that track these indexes. We also incorporate the Chicago Board Options Exchange's Volatility Index (VIX) to capture the perceived risk of U.S. equity markets. Stock market indexes from other countries, such as European or Asian indexes, do not qualify for our criteria given that they leave too much time without trading relative to the Chilean markets.

To measure the return of the Chilean stock market, we use the IPSA index, the main stock market index in Chile.[10] Since the statements are released after the financial markets close, the proper return is obtained by comparing the closing level of the IPSA on the day of the policy meeting with the opening level on the following day. We decided against this option, however, because the two values are the same in roughly the first half of the sample but not in the second half of the sample. We assume that this reflects a change in the methodology for calculating the index.[11] We therefore decided to compare the closing level on the day of the policy meeting with the closing level

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10. *Índice de Precio Selectivo de Acciones* (IPSA). Other stock market indexes either have a more limited number of stocks (the Inter-10 index only measures the return of ten stocks) or are simply a disaggregation of the IPSA.

11. We called the Santiago Stock Exchange, which produces the index, but they could not provide an explanation for this characteristic of the data. We also tried obtaining intraday data to use as an alternative; however, records of this type are not kept by the exchange, and Bloomberg keeps data only for the last 200 days.

on the following day. By including a measure of the U.S. stock market that covers the same period, we expect to capture much of the new information released outside Chile. Furthermore, since Chile is mainly a copper exporter, we add the change in the copper price. Finally, we also include the West Texas Intermediate (WTI) oil price, since oil is the country's main import.

In the case of the bond market, we use swap rates in Chilean pesos for three-month, six-month, and one-year interest rates. We also use, for the long part of the yield curve, the five-year and ten-year central bank bond rate. As controls for events in the international financial system, we include U.S. Treasury bills and bonds (at three months, six months, one year, five years, and ten years), the WTI oil price, and the copper price. We also include the change in the Emerging Market Bond Index (EMBI) spread and one-year-ahead inflation expectations.

Sentiment Analysis

Monetary policy statements include information not only on policy decisions but also on the economic outlook. These statements may then update beliefs regarding Chile's current economic fundamentals and expectations for future policies.[12] Given the importance of the statements, we assess the information in these documents using the dictionary method of content analysis. With this assessment, we build an index that measures whether the bias, or tone, of each press release leans toward promoting growth or controlling inflation. We call this index the sentiment score.

The dictionary method is widely used to measure sentiment in the finance literature.[13] In economics, it has been used to evaluate the impact of policy documents and social media texts.[14] As Hansen and McMahon (2016) point out, the main benefit of this approach is that it is scalable to a given type of document with much less concern about consistency and transparency. At the same time, our approach incorporates the context and usual syntax of the policy documents, so it captures many of the nuances that are lost with fully automated methods.

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12. Because of the construction of available data, we could not identify which expectations are driving the effect. Our results are the aggregate effect of this set of information.

13. See Tetlock, Saar-Tsechansky, and Macskassy (2008) and Loughran and McDonald (2014) for additional references.

14. See, for example, Rosa (2011) and Tadle (2020b).

Following the methodology presented in Tadle (2020a), we first compiled the monetary policy documents and manually reviewed them to identify the most frequently occurring critical terms.[15] We then categorized these terms as either keywords or modifiers. The former were chosen from the set of words based on their relevance to discussions on inflation (such as the terms inflation, inflationary, and prices), the state of the economy (for example, employment, growth, and output), and financial markets (for example, financial and markets).[16] The rest of the terms were labeled as modifiers, since they convey clarity and information about the keywords. We separate the modifiers into two categories, positive and negative.[17] By incorporating these keywords and modifiers in a dictionary, we are able to assess the tone of the sentences in the press releases. For example, the keyword inflation does not provide any information about tone on its own. However, when the keyword inflation is combined with the modifier increasing, we can infer that the policy tone leans toward trying to lower inflation.[18]

The keywords are separated into two categories, dovish and hawkish. Dovish keywords represent a subdued inflation outlook and, when combined with a positive modifier, show discussions leaning toward expansionary

15. In this evaluation, we omit stop words, terms that commonly occur in documents but do not add economic meaning to the press releases.

16. Omitting financial market terms does not significantly affect the results.

17. Taking the roots of the terms changes the context of the examined information, so their conjugations are maintained. The positive modifiers are: above, accelerated, acceleration, active, advantageous, appreciate, appreciated, appreciation, aggravated, better, dynamic, elevated, exceed, exceeded, expand, expanded, expanding, expansionary, favorable, gained, good, grow, high, higher, highs, improve, improved, improvement, improvements, increase, increased, increasing, normalize, normalizing, optimistic, outpacing, outperformed, over, positive, progressing, propitious, raise, rapidly, rebound, recover, recovered, regained, rise, risen, rising, robust, rose, significant, solvency, sound, stabilization, steadily, stirring, strengthening, strengthened, strong, stronger, strongly, up, upturn, vigor, vigorous, and vigorously. The negative modifiers are: adverse, below, constrained, cuts, decelerate, decelerating, decline, declined, declines, decreased, depreciated, depreciation, depressed, descend, deteriorated, deterioration, diminishing, diminished, dismal, doubts, down, downward, downwards, drop, dropped, dropping, ease, eased, eases, fall, fallen, falling, fell, flat, fragile, fragility, harsher, idle, intensification, limited, lose, losing, lost, low, lower, lowered, milder, mitigated, moderating, negative, pause, pessimistic, poor, postponed, postponing, receded, reduced, reductions, restrictive, slack, slow, slowdown, slowed, slower, slowly, sluggish, smaller, stringent, subdued, suffering, tension, tensions, tight, tightened, turbulence, undermined, volatile, vulnerable, weak, weaker, weakness, worse, and worsened.

18. Because of this initial subjective input to create the dictionary, we refer to our applied methodology as semi-automated. It has the benefit of closely incorporating the structure and syntax of the press releases while still maintaining a transparent and consistent analysis of the policy documents.

policy, whereas hawkish keywords represent a more substantial inflation risk and, when combined with a positive modifier, reflect sentiments that lean toward contractionary policy. For example, the combination of the keyword *prices* and the modifier *high* results in the phrase *high prices*, which indicates a hawkish sentiment; the keyword *prices* is thus categorized as hawkish. Similarly, the combination of the keyword *unemployment* and the positive modifier *rising* results in the phrase *rising unemployment*, which indicates a dovish sentiment; hence the keyword *unemployment* is categorized as dovish. When we replace the positive modifiers with negative modifiers, the tone of the phrase changes to the opposite sentiment. For example, combining the keyword *price* and the negative modifier *low* results in the dovish phrase *low prices*. Similarly, the keyword *unemployment* with the negative modifier *decreased* yields the hawkish phrase *decreased unemployment*.[19]

After compiling the list of keywords and modifiers, we systematically calculate the sentiment index using our prepared computer algorithm. The dictionary method is implemented by keeping only those sentences that contain at least one keyword and eliminating the rest of the sentences. The sentences that are removed do not incorporate information related to the economic outlook, particularly regarding inflation. Those that are kept are evaluated based on the types of keywords and the number of modifiers they contain.[20]

The descriptive statistics of the press releases are shown in table 1. On average, the monetary policy releases had about thirteen sentences, while the average number of keywords per policy statement was a little under eighteen per document. These statistics together imply that some sentences contain multiple keys. Sentences that have the same type of keyword—all hawkish or all dovish—are scored as if they had only one keyword. In the case of sentences with both hawkish and dovish keywords, we found, on closer evaluation, that the structure of these sentences generally conveys information

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19. Dovish keywords considered in the analysis are: exchange, peso, recession, turbulence, and unemployment. Hawkish keywords are: Accounts, activity, confidence, consumption, copper, demand, economic, economies, economy, employment, expenditure, federal, financial, growth, indicators, inflation, inflationary, international, investment, job, lending, markets, output, price, prices, and yen.

20. Our approach is similar to Hansen and McMahon (2016) except that our keywords are chosen based on an examination of the documents and are related to Chile's inflation-targeting regime. Furthermore, we conduct market sentiment analysis using a given list of modifiers explicitly tailored to the Chilean monetary policy reports. In contrast, Hansen and McMahon (2016) use latent Dirichlet allocation, a fully automated linguistics method, to choose keywords, and they apply widely available word lists to examine the tonality of the text.

TABLE 1. Descriptive Statistics of the Analyzed Text

Statistic	Sentences	Keywords	Positive modifiers	Negative modifiers
Mean	13.05	17.56	7.09	4.38
Standard deviation	2.46	4.56	3.64	2.67
Maximum	19	29	22	13
Minimum	7	9	2	0

Note: The table shows the number of sentences, keywords, and modifiers in the monetary policy press releases.

similar to sentences that have only hawkish keywords. We therefore scored these sentences as if they had only hawkish keywords.[21]

In addition, there is a mix of positive and negative modifiers in the policy releases, and some sentences have multiple modifiers. These modifiers tend to expand the message connected to the keywords in the text and are accounted for as follows. Sentences with hawkish keywords that have more positive than negative modifiers are given a score of +1, while sentences with hawkish keywords that have more negative than positive modifiers are scored –1. The opposite scoring strategy is conducted for sentences with dovish keywords. If a sentence with a dovish term has relatively more positive modifiers, it is given a score of –1; if it has relatively more negative modifiers, it is scored +1. Sentences with an equal number of positive and negative modifiers are given a score of 0.[22] For example, the August 2011 policy statement contains the sentence, "Copper and oil prices have posted substantial reductions in recent weeks." This sentence has two hawkish keywords (*copper* and *prices*) and one modifier (*reductions*), which is negative. In keeping with the scoring metric, the sentence is given a score of –1, implying that it conveys a dovish sentiment. In contrast, the December 2014 policy statement includes the sentence, "Annual headline inflation dropped, but it remains above 5 percent and core indicators are above 4 percent," which has two hawkish keywords (*inflation* and *indicators*), two positive modifiers (*above,* used twice), and one negative modifier (*dropped*). The sentence thus receives a score of +1, which reflects its hawkish tone.

We do not differentiate the degree of hawkishness or dovishness in a sentence for two reasons. First, we want to avoid exposing the scoring metric to additional subjectivity. Second, the addition of within-sentence variation in

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21. The omission of these sentences does not significantly affect the results.

22. We also account for negation terms. In particular, we reverse the weight of a modifier if the terms *ceased, leaving, less, no,* or *stopped* are found within three words of the modifier.

F I G U R E 2 .   Monetary Policy Statement Sentiment Scores and the MPR
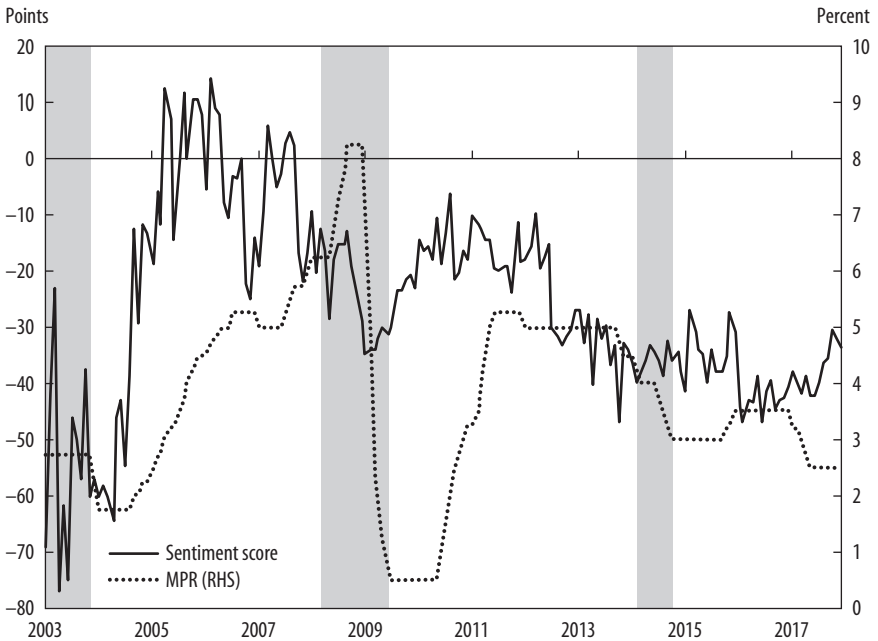
Source: Authors' calculations and the Central Bank of Chile.

scoring creates ambiguity that makes the categorization much more difficult to conduct and quantify. Once the sentences have been scored, the next step is to aggregate the scores of the sentences in each policy statement. We then divide the aggregate score by the number of evaluated sentences in each document. After scaling by 100, we create a continuous sentiment measure that ranges from –100 to 100.

Analyzing the Sentiment Score over Time

We apply the dictionary method to the monthly policy statements released from January 2003 to December 2017. This period covers the extreme drought, the international financial crisis of 2008–09, and the implementation of the effective MPR lower bound in Chile. Figure 2 shows the corresponding series. The general path of the sentiment index can be described as follows. After a period of great volatility in 2003, the sentiment score index increased rapidly in 2004. This increase preceded the rapid increase in the MPR. The index

FIGURE 3. Cross-Correlogram: Statement Score Index and MPR
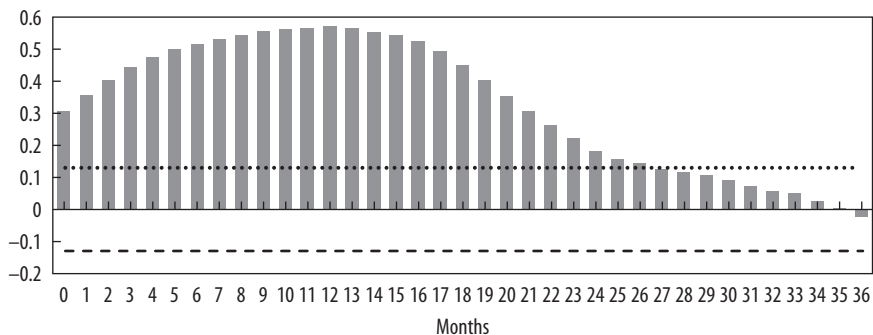
Source: Authors' calculations.

then decreased, moving into a period of mild dovishness in 2007. It increased again in 2008, when the global financial crisis hit. After 2010, the sentiment index stabilized in the range of –10 to –20 points, before dropping from –15 to –31 points between June 2012 and August 2012. This drop in hawkishness reflects concerns about the economy's growth prospects. Thereafter the index mostly measured around –30 to –40 points, in line with a slower economy.

Figure 2 also shows that movements in the statement sentiment index are followed shortly by similar changes in the MPR, including the MPR increases in 2005 and 2010 and the MPR decreases in 2009 and 2014. The pattern suggests that sharp changes in the index signal future changes in the MPR. This may reflect the fact that risks to growth and inflation are highlighted in the statements well before actual changes are made to the MPR. To test this hypothesis, we built a cross-correlogram between the sentiment score index and the MPR. As shown in figure 3, the index precedes the MPR by about twelve months, when the correlation is the highest.[23] We also built a cross-correlogram of the sentiment score and the systematic component of the MPR, with almost identical results.[24] This hypothesis is further supported

23. Lucca and Trebbi (2011) report similar results, in which a shock to the Fed's statement sentiment index signals a corresponding change in the U.S. federal funds rate.

24. The methodology for estimating the systematic component of the MPR is presented in the online appendix (available at http://economia.lacea.org/contents.htm). The resulting correlogram is available on request.

F I G U R E 4 . Volatility: Sentiment Score Index and Macroeconomic Indicators
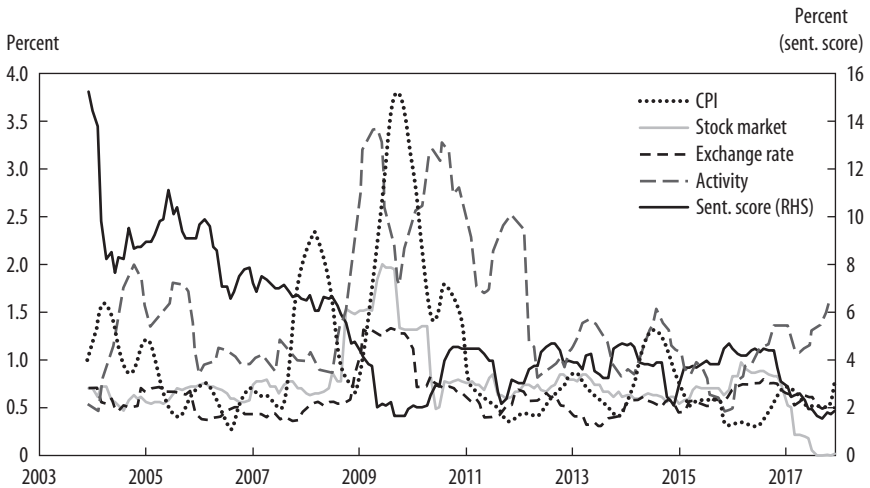
Source: Authors' calculations.

by the results of a simple recursive VAR, presented later in the paper. Finally, a Granger causality test also supports the notion that our sentiment score Granger causes movements in the MPR. The results demonstrate that at the 5 percent significance level, we cannot reject the null hypothesis that monetary policy does not precede the sentiment score, but we can reject the hypothesis that the sentiment score does not precede monetary policy.

In terms of monetary policy communication, the evidence presented here indicates that the CBC provides a significant amount of relevant information to the public. The CBC begins changing the tone of its monetary policy press releases well before an actual change in the MPR takes place. This makes MPR movements highly predictable.

Another important characteristic of the index is that its volatility has decreased sharply, as shown in figure 4.[25] Volatility was highest at the beginning of the sample, after which it declined steadily. This potentially reflects a learning process within the CBC regarding the optimal way to communicate its monetary policy decisions, insofar as the sample starts with the very first

25. As a measure of volatility, we use the twelve-month moving standard deviation of the difference between the raw index and the six-month moving average.

TABLE 2. Average Volatility

Indicator	Before 2009	After 2010	B/A ratio
Sentiment score	8.2	3.6	0.44
Economic activity	1.2	1.3	1.04
CPI inflation	0.8	0.6	0.75
Stock market returns	0.7	0.6	0.91
Exchange rate	0.5	0.6	1.05

monetary policy statements published by the board. Alternatively, there may have been a reduction in macroeconomic volatility that could, in turn, lead to a reduction in the volatility of the sentiment score.[26] We examine this hypothesis by examining the volatility of inflation, stock market returns, the exchange rate, and aggregate activity along with the volatility of the sentiment score. Figure 4 shows that the volatility of these series did not change over the sample period, with the exception of the global financial crisis. Table 2 shows the average volatility before and after the financial crisis and the ratio between these two volatilities. Although the ratio of the sentiment score decreased sharply, the volatility of the other series was relatively constant. Therefore, we cannot state that a decrease in macroeconomic volatility caused the decrease in the volatility of the sentiment score.

Monetary Policy Communication Effectiveness: Empirical Analysis

In addition to analyzing the effect of MPR surprises on the real economy and the financial sector, we are interested in understanding the effect of the sentiment score on financial variables. Therefore, following Pescatori (2018), we first assess the ability of the CBC to affect market expectations, which, in turn, affect the real economy. As such, we study the effect of monetary policy on the Chilean stock and bond markets. Second, we study the effects of monetary policy—the MPR and the sentiment score—on the whole economy. We do this by building a simple open-economy VAR model. This methodology also allows us to study the relationship between the sentiment score and the MPR, and we use this evidence to support the results of the previous section.

26. We would like to thank our referees for suggesting this idea.

The Unexpected Component of the Sentiment Score

As shown above in figure 2, the sentiment score has fluctuated over time, but changes in sentiment have become more gradual since 2005. Rosa (2011) makes a similar observation about the FOMC statements, arguing that the change reflects the persistent fundamentals discussed in the meeting documents. Given this persistence in the sentiments, there may be some expected components in these documents. Therefore, we need to differentiate the unexpected component from the expectations, since the surprise information is what could potentially cause financial market reactions.

To obtain the unexpected component of the sentiment score, we follow a logic similar to the Taylor rule. We adopt the idea that the sentiment score can be (mostly) explained by its previous values and the forecasts for inflation and growth. Any unexplained component of the sentiment score then represents a shock to the monetary policy stance. To obtain this unexpected component of the sentiment score, we use the following specification:[27]

(1) $$SS_t = \alpha_0 + \alpha_1 SS_{t-1} + \alpha_2 SS_{t-2} + \alpha_3 CPI_t^{ex} + \alpha_4 CPI_{t-1}^{ex}$$

$$+ \alpha_5 CPI_{t-2}^{ex} + \alpha_6 Y_t^{ex} + \alpha_7 Y_{t-1}^{ex} + \alpha_8 Y_{t-2}^{ex} + u_t,$$

where SS_t is the sentiment score for period t, CPI_t^{ex} is the one-year-ahead expected consumer price index (CPI) inflation rate, and Y_t^{ex} is the one-year-ahead expected monthly GDP growth rate as measured by the growth rate of the Monthly Economic Activity Index (IMACEC).[28] These forecasts are obtained from the CBC Economic Expectations Survey.[29]

Table 3 shows the results for two different specifications of equation 1. In the first set of results, the terms relating to the expected growth rate of the IMACEC index are omitted, while in the second set, the full specification is used. The results show that the monetary policy sentiment score is mainly affected by expected inflation and by lagged values of the sentiment score itself, while expected growth does not seem to have any significant impact

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27. Using the maximum likelihood estimation gives similar results.
28. *Índice Mensual de Actividad Económica* (IMACEC), maintained by the CBC.
29. The *Encuesta de Expectativas Económicas* is a monthly survey conducted by the CBC of a group of academics, consulting firms, and financial executives about a large number of macroeconomic variables.

TABLE 3. Regression Results for Equation 1

Explanatory variable	(1)	(2)
Constant	0.77	−0.61
	(3.34)	(0.43)
Lagged sentiment score (SS_{t-1})	0.57***	0.56***
	(0.10)	(0.10)
Lagged sentiment score (SS_{t-2})	0.32***	0.31***
	(0.11)	(0.11)
Inflation expectations (CPI_t^{ex})	6.72***	6.48***
	(2.33)	(2.39)
Lagged inflation expectations (CPI_{t-1}^{ex})	−2.85	−2.92
	(3.55)	(3.59)
Lagged inflation expectations (CPI_{t-2}^{ex})	−4.98**	−4.89**
	(2.37)	(2.44)
IMACEC expectations (Y_t^{ex})		0.13
		(0.43)
Lagged IMACEC expectations (Y_{t-1}^{ex})		0.19
		(0.53)
Lagged IMACEC expectations (Y_{t-2}^{ex})		0.07
		(0.44)
Summary statistic		
No. observations	178	178
R^2	0.77	0.77
F test	0.00	0.00

**$p < 0.05$; *** $p < 0.01$.
Notes: The dependent variable is the sentiment score in period t (SS_t). In column 1, the terms relating to the expected growth rate of the IMACEC index are omitted; in column 2, the full specification is used. Standard errors are in parentheses.

on the sentiment score.[30] These results are comparable to recent estimates of the Taylor rule, which show that the Chilean MPR has an important level of inertia and responds strongly to inflation and mildly to growth.[31] This is consistent with the idea that the CBC is mandated to stabilize inflation only, and not necessarily growth. Therefore, we take a parsimonious approach by excluding growth terms in our main specification.

We denote the unexpected component of the statements score as SS_t^s, which is the part of SS_t that is not explained by version 1 of equation 1. This, in turn, means that

$$(2) \qquad\qquad SS_t^s = u_t.$$

30. We test for the total effect of inflation over the sentiment score, and we find that it is positive and significant. In fact, the addition of output growth does not affect the R^2 of the regression explaining the statement index.
31. See Medina and Soto (2007) and García-Schmidt and García-Cicco (2018) for references.

Effect on the Stock Market

Given the timing of the release of the policy statements, we use the IPSA daily returns as the main dependent variable for examining the reaction of equity markets.[32] We denote the closing price of the IPSA on day t as X_t and calculate x_t, the daily return on the IPSA, as follows:

$$(3) \qquad x_t = \frac{X_t - X_{t-1}}{X_{t-1}}.$$

We include day t in our analysis only if a policy meeting occurred on day $t-1$. To calculate the monetary surprise, MPR_t^s, we compare the effective value of the MPR with the median value of the MPR forecast in the Bloomberg survey. In this case, the surprise element is of the form

$$(4) \qquad \text{MPR}_t^s = \text{MPR}_t - E_t\left(\text{MPR}_t^{\text{BBG}}\right),$$

where $E_t\left(\text{MPR}_t^{\text{BBG}}\right)$ is the expected value of the MPR from Bloomberg and MPR_t is the effective value of the MPR.

As figure 5 demonstrates, there is a very weak correlation between the two types of surprise. This is consistent with the claim that the sentiment index helps the market form expectations about future MPR values. In addition, both types of surprise were more volatile in the earlier part of the sample. The volatility of the MPR then declined after a spike at the onset of the global financial crisis. This suggests that the CBC became more effective in guiding market expectations for the MPR. The volatility of the sentiment surprises also decreased. This supports the idea that the policy statements are changed gradually and thus exhibit persistence.

To estimate the effect of monetary surprises on the financial variables of interest, we use the following specification:

$$(5) \qquad x_t = \delta_0 + \delta_1 r_t^{\text{US}} + \delta_2 \text{MPR}_t^s + \delta_3 \text{SS}_t^s + \delta_4 \text{WTI} + \delta_5 \text{COPPER} + \varepsilon_t,$$

where r_t^{US} is the daily return of the SPDR S&P 500 exchange-traded fund (SPY), SS_t^s is the surprise component of the sentiment indicator, WTI is the daily return of the WTI crude oil price, COPPER is the daily return of the

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32. This way of measuring the impact of monetary policy on Chilean financial variables is also used by Acuña and Pinto (2015) and García-Herrero, Girardin, and González (2017).

FIGURE 5. Monetary and Sentiment Surprises
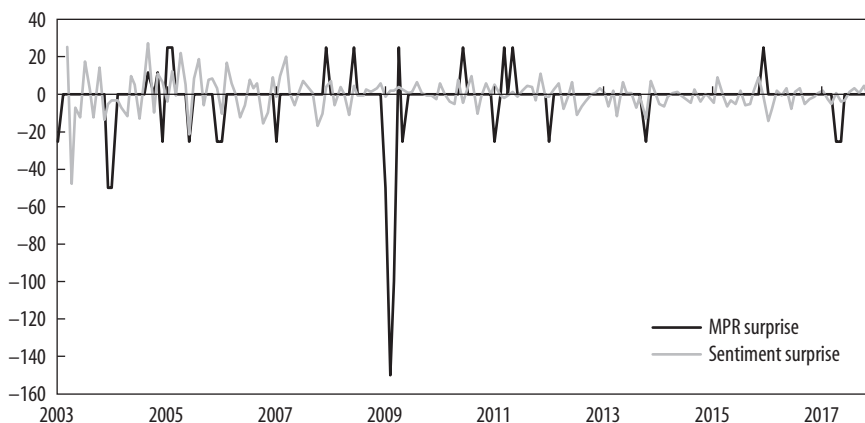
Source: Authors' calculations.

copper price, and ε_t is the error term.[33] As explained earlier, the types of policy that were implemented before the crisis were mainly MPR movements, whereas after the crisis different policies were implemented.[34]

We test for the possibility of a structural break in the relationship between monetary policy and stock market returns since the sample period includes the global financial crisis of 2007–09, a period that saw a significant increase in attention to the interactions between financial market activity and monetary policy. To test this hypothesis, we use the cumulative sum of squares (CUSUMSQ) test for coefficient stability, following Brown, Durbin, and Evans (1975).[35] The results of the test, shown in figure 6, indicate that there is a structural break around September 2008 for the stock market. To account for this structural break, we include a dummy variable, D08, which takes

33. Calculations for the daily returns follow a similar calculation as the daily return for the IPSA. We obtain similar results when we replace the SPY with alternative measures of the U.S. stock market. The measures we tested were the Dow Jones Industrial Average (DJIA) index, the S&P 500 index, and the ETF that follows the DJIA.

34. The policies implemented after September 2008 are not easily quantifiable and are beyond the scope of our current analysis.

35. The CUSUMSQ test is based on the cumulative sum of the quadratic values of the recursive residuals, which are the one-step-ahead forecast errors of the dependent variable. The test plots the cumulative sum alongside 5 percent critical lines. Any movement of the cumulative sum outside the critical values suggests coefficient instability.

FIGURE 6. Stability Test
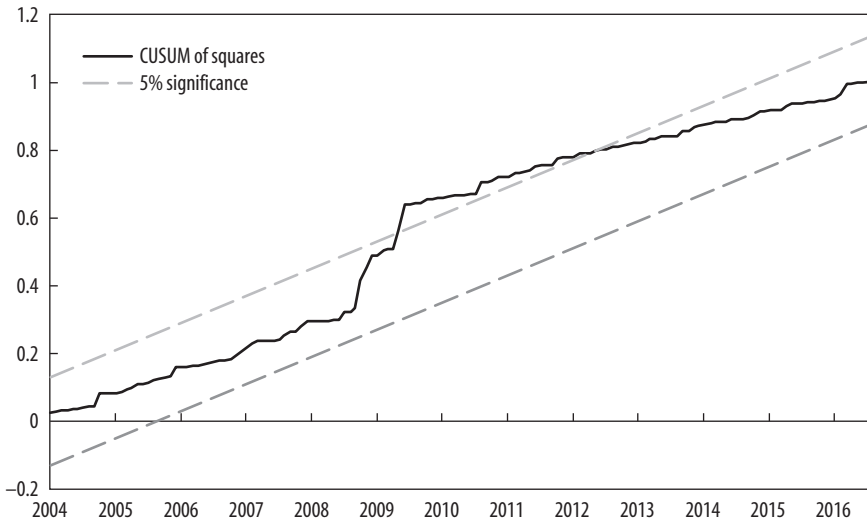
Source: Authors' calculations.

a value of zero through August 2008 and a value of one thereafter.[36] The dummy variable is included in the regression to capture two possible changes: an intercept break in stock market returns and a change in the effect of monetary policy and sentiment surprises.[37]

The estimated equation that takes into account the possibility of a structural break is

$$(6) \qquad x_t = \beta_0 + \beta_1 D08 + \beta_2 r_t^{US} + \beta_3 MPR_t^s + \beta_4 MPR_t^s \times D08$$
$$+ \beta_5 SS_t^s + \beta_6 SS_t^s \times D08 + \beta_7 WTI + \beta_8 COPPER + z_t,$$

where z_t is the error term. Table 4 shows the results for both of our regressions: the baseline regression and the one that accounts for the structural change in September 2008. The baseline regression shows that the Chilean stock exchange moves in the same direction as changes in the U.S. stock market.

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36. This approach of dividing the sample in two is also used by García-Herrero, Girardin, and González (2017).

37. Including the interaction term for other explanatory variables does not alter the results.

T A B L E 4. Effects on the Stock Market

Explanatory variable	Baseline	Structural break
Constant	13.35	11.22
	(9.46)	(9.47)
D08	−23.59*	−19.76
	(12.12)	(12.10)
r_t^{US}	22.33**	21.97**
	(10.01)	(9.03)
Monetary surprise	−0.29	−1.69**
	(0.37)	(0.72)
Monetary surprise × D08		2.05**
		(0.82)
Sentiment surprise	0.07	−0.41
	(0.64)	(0.64)
Sentiment surprise × D08		3.90**
		(1.57)
WTI	8.14**	8.63***
	(3.40)	(2.98)
Copper	11.07**	10.61**
	(5.10)	(4.49)
Summary statistic		
No. observations	169	169
R^2	0.25	0.3
F test	0.00	0.00

$*p < 0.1; **p < 0.05; ***p < 0.01.$
Notes: The dependent variable is the daily return on the IPSA (x_t). Standard errors are in parentheses.

Moreover, increases in the copper price have positive and significant effects on the Chilean stock market index. This reflects the fact that increases in the copper price encourage economic growth in Chile.[38] Changes in the WTI price also have a positive and significant effect on the stock market.

With respect to policy, we find that monetary surprises do not seem to affect the equity market when we use the whole sample. Although this result contrasts with the usual findings in the literature, which show that monetary policy surprises have a negative effect on the stock market, it is not new in the literature for Chile. Acuña and Pinto (2015) find no significant effects of monetary policy shocks on the stock market. In addition, Pescatori (2018) shows that the significance of the results depends on how the monetary policy

---

38. There is no publicly traded copper-producing firm in the stock market, so the observed market reaction to copper is an indirect effect and thus is smaller than it might be otherwise.

surprise indexes are constructed: monetary policy surprises constructed from survey data show no significant effect, while the measure constructed from interest rate data does have a significant impact. Similarly, the new information revealed by the surprise component of the statements does not seem to have any effect on the Chilean stock market index.

The results are notably different when the structural change is considered. While the U.S. stock market, copper price, and WTI price continue to have positive and significant effects, the response of the Chilean stock market to monetary policy and sentiment surprises has changed. In the first half of the sample, monetary surprises have a negative and significant impact on the stock market. This finding is in line with the economic intuition and the results found in previous literature. During this period, a monetary policy surprise increase of 25 basis points lowers the return of the index by 42.25 basis points. At the same time, sentiment surprises did not have a significant impact on equity markets.

The overall impact of policy and sentiment surprises changed in the second half of the sample period. The impact of policy surprises became positive and also more substantial in magnitude than in the first half of the period, while remaining statistically significant at the 5 percent level. Furthermore, the estimated impact of sentiment surprises became positive and significant at the 5 percent level in the second half of the sample.[39]

To further examine the statistical significance of the impact of the policy and sentiment surprises in the second half of the sample, we conduct two coefficient tests. We examine whether the sum of the coefficient estimates corresponding to the policy rate surprises ($\beta_3 + \beta_4$) and the sum of the coefficient estimates for the sentiment surprises ($\beta_5 + \beta_6$) are significantly different from zero. The coefficient test results suggest that monetary surprises may not have a significant impact on stock market returns in the second half of the sample ($p = 0.20$). In contrast, sentiment surprises have a positive and significant impact on the stock market index ($p = 0.02$). This is perhaps because an unexpectedly more hawkish statement also reveals a more positive economic forecast, thereby situating Chile's economic outlook in a more positive light.

The differences between the baseline and the structural change regression results show that the market has changed the way it responds to monetary

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39. Changing the sentiment index to the deviation from its average does not significantly affect the results.

FIGURE 7. Interest Rates

Percent
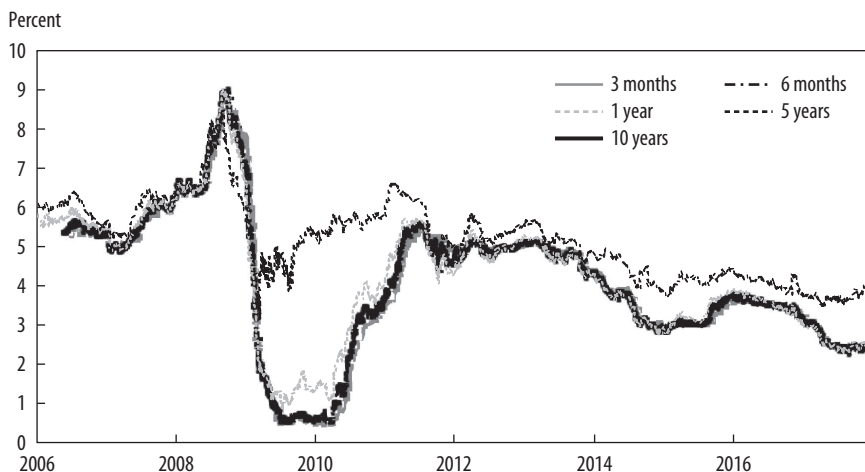
Source: Bloomberg.

policy announcements. Before the crisis, the market focused almost exclusively on changes to the MPR. After the economic downturn, it incorporated the information revealed in the statements instead of solely basing its actions on policy decisions.

Effect on Central Bank Bond and Swap Rates

Following previous work on the effects of MPR shocks on interest rates, we examine interest rate changes that occur after the release of new information. Taking r_t as the interest rate of a fixed-income instrument on day t, we examine the change between the date of the announcement and the following day. The variable of interest for the bond market is then given by $\Delta r_t = r_t - r_{t-1}$.[40]

When considering the dependent variable, we examine nominal swap rates for different horizons: three months, six months, and one year. We also evaluate the interest rates on five- and ten-year nominal CBC bonds. These series are shown in figure 7. Our specification for the empirical analysis is similar to the one we used for the stock market. One important difference

40. This measure quantifying the effect of monetary policy surprises is also used by Cook and Hahn (1989), Larraín (2005, 2007), Meyer (2006), and Ceballos (2014).

is that we replace the U.S. equity price change with the change in the U.S. interest rate at the same maturity. We also add the Chilean Emerging Market Bond Index (EMBI) spread as a measure of the Chilean risk level, as well as the expected inflation gap. The specification that we use to estimate the effects of monetary policy on the fixed-income market is then given by

$$
(7) \qquad \Delta r_{i,t} = \gamma_{i,0} + \gamma_1 \Delta r_{i,t}^{\mathrm{US}} + \gamma_2 \mathrm{MPR}_t^s + \gamma_3 \mathrm{MPR}_t^s \times \mathrm{D08} + \gamma_4 \mathrm{SS}_t^s
$$
$$
+ \gamma_5 \mathrm{SS}_t^s \times \mathrm{D08} + \gamma_6 \mathrm{WTI} + \gamma_7 \mathrm{COPPER} + \gamma_8 \Delta \mathrm{EMBI}^{\mathrm{CL}}
$$
$$
+ \gamma_9 \overline{\pi}_t^e + \gamma_{10} \mathrm{D08} + \varepsilon_t,
$$

where $\Delta r_{i,t}$ is the daily change in the interest rate for time horizon i, $\Delta r_{i,t}^{\mathrm{US}}$ is the change in the U.S. interest rate for the respective maturity, $\Delta \mathrm{EMBI}^{\mathrm{CL}}$ is the change in the EMBI spread, and $\overline{\pi}_t^e$ measures the difference between eleven-month-ahead inflation expectations and the inflation target. We also include WTI and COPPER (the percentage change in the price of WTI crude oil and copper, respectively) as controls. The interest rate data are collected from Bloomberg and start in 2006, when the instruments became more liquid and therefore had more frequent transactions.[41]

The results of estimating this regression for all of the interest rates are presented in table 5. In line with the literature, the MPR surprises appear to have a statistically significant and decreasing monotonic effect on interest rates up to the five-year horizon. The effect on the ten-year rate is not only the smallest but also statistically insignificant. In contrast, the sentiment surprise is estimated to have a positive and statistically significant impact only for the three-month and six-month swap rates.

Table 5 also presents the results of the coefficients tests to evaluate the effect of monetary policy after 2008. For the fixed-income market, there seems to be no evidence of a structural break, given the lack of significance of the coefficients on the dummy variable and the interaction terms. This is probably because the sample starts in 2006, not long before the financial crisis. Nevertheless, we examine whether the sum of the coefficient estimates corresponding to the policy rate surprises and the sum of the coefficient estimates for the sentiment surprises are significantly different from zero. The coefficient

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41. Data spanning a more extended period are available from RiskAmerica. However, this data set is based not only on market data but also on statistical modeling to fill in the gaps. An exercise that uses this data set can be found in the robustness section. The results are similar to the ones found using Bloomberg data.

TABLE 5. Effects on Interest Rates

Explanatory variable	Dependent variable				
	Nominal swap rate			Nominal CBC bond rate	
	3 months	6 months	1 year	5 years	10 years
Constant	−12.69*	−5.25	−5.28	−0.78	0.73
	(7.25)	(4.23)	(3.80)	(5.71)	(3.91)
U.S. rate	0.30**	0.21	0.39**	−0.09	0.11
	(0.14)	(0.26)	(0.17)	(0.13)	(0.11)
Monetary surprise	0.52***	0.57***	0.39**	0.19**	0.12
	(0.16)	(0.19)	(0.16)	(0.09)	(0.10)
Monetary surprise × D08	0.08	−0.12	−0.20	0.03	−0.04
	(0.15)	(0.18)	(0.17)	(0.10)	(0.10)
Sentiment surprise	0.21*	0.27**	−0.00	0.03	0.09
	(0.11)	(0.11)	(0.09)	(0.07)	(0.06)
Sentiment surprise × D08	−0.20	−0.25	0.06	−0.06	−0.04
	(0.18)	(0.16)	(0.15)	(0.11)	(0.10)
WTI	0.05	0.52*	0.71**	0.76***	0.12
	(0.36)	(0.30)	(0.31)	(0.28)	(0.24)
Copper	0.52	0.49	0.19	0.14	0.51
	(0.63)	(0.49)	(0.40)	(0.46)	(0.37)
Chilean EMBI Spread	0.13*	−0.02	0.00	−0.00	0.03
	(0.06)	(0.08)	(0.07)	(0.04)	(0.04)
Inflation expectations	4.43*	1.30	1.90*	−0.01	−0.62
	(2.51)	(1.26)	(1.10)	(1.71)	(1.15)
D08	−0.31	1.83	−0.04	0.03	0.71
	(1.91)	(1.58)	(1.49)	(1.13)	(1.05)
Summary statistic					
No. observations	126	134	154	144	143
R^2	0.69	0.61	0.29	0.31	0.13
F test	0.00	0.00	0.00	0.01	0.04
Coefficient test (p value)					
Monetary effect after 2008	0.00	0.00	0.03	0.02	0.20
Sentiment effect after 2008	0.97	0.82	0.60	0.79	0.46

$*p < 0.1; **p < 0.05; ***p < 0.01.$
Note: Standard errors are in parentheses.

test results indicate that monetary surprises have a significant impact on the bond market in the second half of the sample, while the effect of the statement sentiment is not significant for any of the horizons.

Our results are mostly consistent with Pescatori (2018), although he finds that the information provided in the press releases can affect the whole yield curve, whereas our results show a significant effect only on the short end. This probably reflects an essential difference in the methodology for calculating

the information effect of press releases. Specifically, Pescatori (2018) uses a dummy to signal whether there was an MPR surprise and then measures the information effect by regressing different swap rates against the three-month rate. This is potentially problematic, however, because it does not account for the message in the press releases and does not allow for the possibility of a surprise in the policy rate and in the statement.

Similarly, the IMF (2018) attributes the effect of words to the change in the R^2 of a regression when the sentiment score is added. As mentioned, this methodology does not capture the notion that only surprises affect the financial market. As such, we believe that our methodology is better suited to analyzing the impact of "words" on the yield curve than the methodology used in these papers.

Hansen and McMahon (2016) disentangle the information in Fed monetary policy statements and classify it as related to either forward guidance or the economic situation. They find that the discussion of the economic situation does not affect the rest of the economic variables, while forward guidance does. In contrast, our methodology finds a positive effect on the shorter end of the yield curve, while maturities over one year do not seem to be affected by the information in the press releases.

Effect on the Real Economy: VAR Analysis

To gain a better understanding of the dynamic effects of the statement sentiment score and the MPR on the rest of the economy, we estimate a small-scale open-economy VAR. To do so, we first follow the broad literature that estimates the effect of monetary policy surprises. As in Christiano, Eichenbaum, and Evans (1999) and Gertler and Karadi (2015), we assume that domestic prices and activity do not respond contemporaneously to monetary policy or sentiment shocks.

Since Chile is a small open economy, the framework must take into account the fact that small economies cannot affect foreign prices. Recent papers that use a VAR to study the Chilean economy include Pescatori (2018), Pérez Ruiz (2016), Sansone and Justel (2016), and Albagli, Naudon, and Vergara (2015). In line with those works, our VAR includes an exogenous sector that incorporates external variables such as international inflation, the interest rate, real activity, and commodity prices. We augment the VAR model by introducing the sentiment score as in Lucca and Trebbi (2011), who use a recursiveness assumption in their VAR to identify monetary policy shocks. As in their case, our sentiment score measure shows a strong cross-correlation

with the MPR.[42] We thus assume that changes in the sentiment score can lead to contemporaneous changes in the MPR, and we employ this assumption by ordering the sentiment score before the MPR in the VAR.

Our VAR is estimated monthly from January 2003 to December 2017 using the following variables: the exchange rate, the non-mining IMACEC index, inflation, the statement sentiment score, and the MPR. The exogenous block is filled with foreign variables relevant to the domestic economy, including the change in the WTI oil price, the change in the copper price, and the S&P 500 return.

Figure 8 shows the resulting impulse responses, with two standard deviations for each function. The figure shows that a statement score shock leads to an initial mild increase in the activity index (IMACEC), followed by a large drop in activity. The effect is significant only after twenty periods. The effect of a monetary policy shock follows a similar pattern, but the drop in activity is stronger and slightly shorter. This effect is significant only around the tenth period. In terms of inflation, a sentiment score shock shows an increase in inflation, although not significant, whereas a monetary policy shock shows the usual price puzzle effect, in which inflation initially increases and then decreases after several periods.

These results seem to imply that the effect of sentiment score shocks on activity and inflation that is milder, lasts longer, and peaks later than the effect of monetary policy shocks. On the other hand, both monetary policy tools seem to be ineffective against the exchange rate, although this could be related to the fact that in Chile, the exchange rate is closely tied to the international copper price.

With regard to the effect on the monetary policy tools themselves, a sentiment score shock leads to a slowly decaying impulse response on itself. This implies that after a surprise change in the tone of the press releases, the central bank slowly changes it back. The effect of the sentiment score on the MPR suggests that the CBC releases information before implementing monetary policy movements. Finally, the effect of a monetary policy surprise on itself seems to imply that after a shock, the central bank may engage in a cycle of monetary policy movements. Changing the order of identification did not alter the results substantially.

Finally, figure 9 shows the forecast error variance decomposition (FEVD). It indicates that the monetary authority affects activity mainly through the

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42. Figure 3 shows the correlation between the sentiment score and the MPR.

F I G U R E   8 .   VAR Results: Real Sector Impulse Response Functions
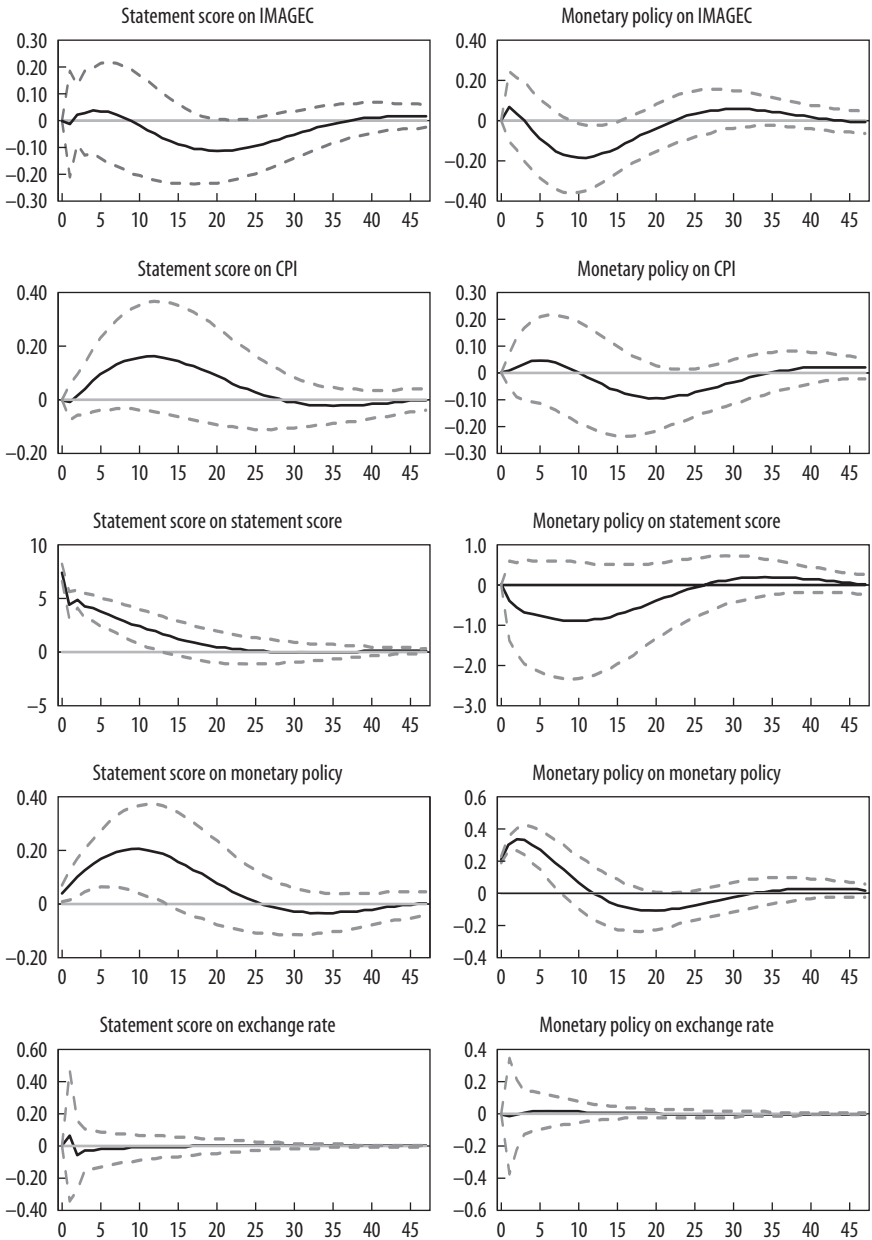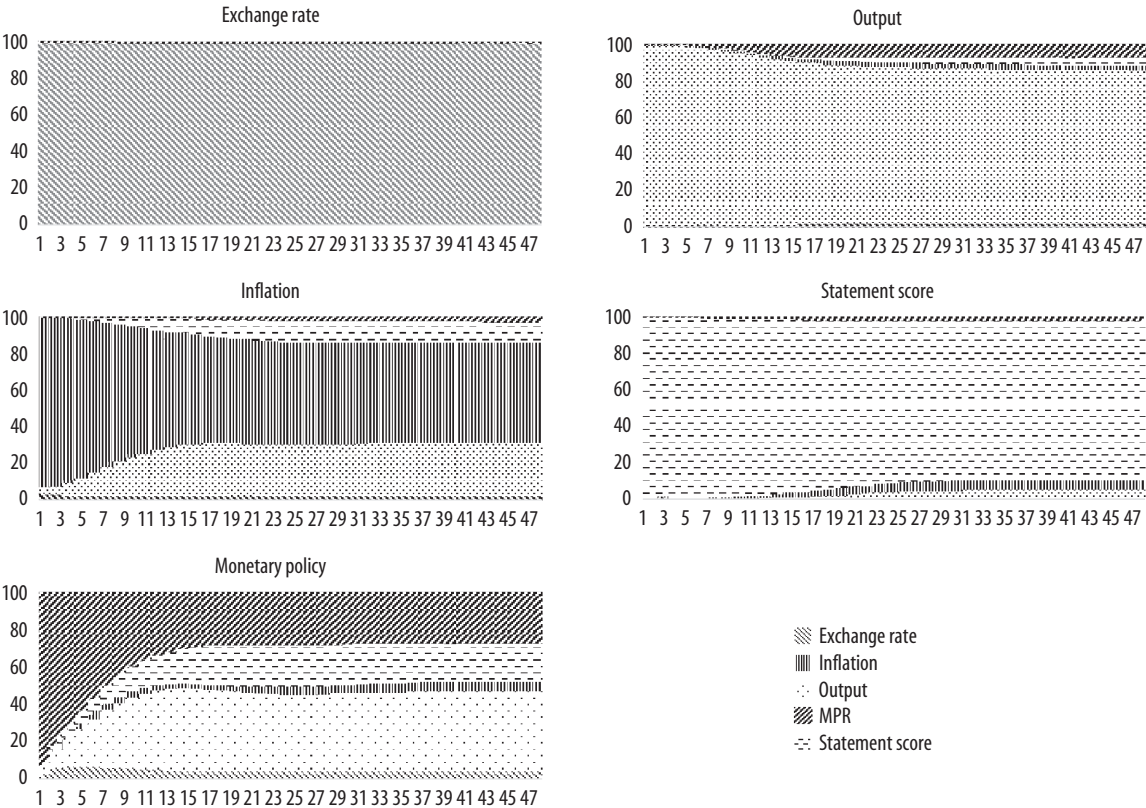
F I G U R E 9 . VAR Results: Forecast Error Variance Decomposition

Source: Authors' calculations.

MPR. In contrast, inflation is not immediately affected by MPR shocks. The sentiment score, in turn, seems to be affected by the rest of the variables in the VAR only after several periods. Finally, the monetary policy rate is strongly affected by activity and the statement score, as well as by itself.

Robustness and Extensions

In this section, we conduct additional experiments to explore the robustness of our results and extend our analysis. Among these experiments, we change the dependent variable to extend the time frame to a two-day return, alter the definition of the sentiment surprise, and extend the sample of interest rate data by including estimated data from a financial services provider. In addition, we change the dictionary in two ways: first to include only terms related to the domestic economy and second to reduce the number of hawkish keywords. Finally, we separate the effect of the sentiment score index from any contemporaneous effect with the monetary policy rate.

Two-Day Return Analysis

The results presented earlier describe the impact of monetary policy based on the one-day return on the stock market and the one-day change in interest rates at different maturities. In particular, we compare the financial instruments at the close of the day on which the monetary policy decision was made and the following day. To examine the robustness of these results, we now consider the change between the day before the policy meeting and the day after the meeting, evaluating the impact on returns as calculated by $(X_t - X_{t-2})/X_{t-2}$ for the stock market and $(r_t - r_{t-2})$ for the fixed-income market. We continue to control for external influences on the financial market as in equations 6 and 7.

The results of the exercise for the stock market mostly confirm our initial conclusions (see table 6). When we consider the full sample, neither MPR surprises nor information surprises seem to affect stock market returns. On the other hand, when we consider the structural break in August 2008, MPR surprises have a negative effect before 2008 and a positive effect after 2008, while sentiment surprises have a positive effect after 2008. When we run the tests for the sum of coefficients, we find that MPR surprises do not seem to have a significant effect after 2008, whereas sentiment surprises seem to have a positive effect after 2008. The main difference is that now the effect of monetary policy surprises before 2008 does not seem to be significant.

TABLE 6. Two-Day Return: Stock Market

Explanatory variable	Baseline	Structural break
Constant	6.67	5.07
	(15.19)	(15.25)
D08	−10.27	−6.34
	(18.41)	(18.64)
r_t^{US}	38.48***	38.54***
	(6.69)	(6.49)
Monetary surprise	−0.24	−1.88
	(0.50)	(1.15)
Monetary surprise × D08		2.36*
		(1.23)
Sentiment surprise	0.38	−0.20
	(1.11)	(1.26)
Sentiment surprise × D08		4.35*
		(2.27)
WTI	4.27	3.69
	(3.31)	(3.19)
Copper	14.11***	13.51***
	(4.72)	(4.70)
Summary statistics		
No. observations	169	169
R^2	0.23	0.29
F test	0.00	0.00
Coefficient test (p value)		
Effect of monetary surprises ($\beta_3 + \beta_4$)		0.28
Effect of sentiment surprises ($\beta_5 + \beta_6$)		0.02

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.
Note: Standard errors are in parentheses.

The results for the fixed-income market are largely unchanged (see table 7). Monetary policy surprises have a positive effect along most of the yield curve in the first half of the sample. Surprisingly, we do not observe a significant impact on the three-month rate. A critical aspect of these regressions is that their R^2 values are markedly lower than those estimated with only the one-day change. This drop is especially notable for the regression on the three-month rate, where the R^2 falls from 0.69 to 0.24. This leads us to believe that other factors need to be accounted for when evaluating the results for one-versus two-day changes. Moreover, the sum of coefficients test reveals that monetary policy surprises have a positive and significant effect on the yield curve, whereas surprises in the press releases do not.

T A B L E 7 . Effects on Interest Rates

Explanatory variable	Dependent variable				
	Nominal swap rate			Nominal CBC bond rate	
	3 months	6 months	1 year	5 years	10 years
U.S. rate	−3.72	0.01	0.02	0.66***	−0.12
	(3.25)	(0.25)	(0.19)	(0.14)	(0.12)
Monetary surprise	0.11	0.58***	0.69***	0.22*	0.25**
	(0.65)	(0.17)	(0.21)	(0.13)	(0.11)
Monetary surprise × D08	0.75	−0.13	−0.35*	−0.09	−0.19
	(0.78)	(0.17)	(0.20)	(0.12)	(0.11)
Sentiment surprise	−0.05	0.16	0.23	−0.06	0.07
	(0.75)	(0.10)	(0.15)	(0.07)	(0.19)
Sentiment surprise × D08	0.12	−0.26	−0.36	0.07	−0.15
	(0.82)	(0.17)	(0.22)	(0.15)	(0.22)
WTI	1.82	0.63**	0.93***	0.16	0.82***
	(1.31)	(0.27)	(0.32)	(0.24)	(0.24)
Copper	0.59	−0.08	0.04	0.08	−0.51
	(1.55)	(0.36)	(0.43)	(0.49)	(0.32)
Chilean EMBI Spread	−0.50	−0.13	−0.11	0.06	−0.03
	(0.39)	(0.08)	(0.09)	(0.06)	(0.09)
D08	−19.3	0.74	−1.55	−2.01	−0.95
	(18.32)	(1.58)	(1.96)	(1.29)	(1.87)
Inflation expectation	0.17	1.33	1.02	−1.88	−1.85
	(7.16)	(1.86)	(1.46)	(1.97)	(2.19)
Constant	17.2	−5.15	−3.04	7.86	4.61
	(29.26)	(6.07)	(5.06)	(6.63)	(7.47)
Summary statistic					
No. observations	126	131	131	131	131
R^2	0.24	0.59	0.5	0.48	0.16
F test	0.00	0.00	0.00	0.01	0.04
Coefficient test (p value)					
Monetary effect after 2008	0.00	0.00	0.00	0.00	0.39
Sentiment effect after 2008	0.82	0.49	0.45	0.85	0.54

$*p < 0.1; **p < 0.05; ***p < 0.01.$
Note: Standard errors are in parentheses.

Altering the Specification Used for the Sentiment Shock

The observed impact of the sentiment shock may be affected by how quickly the public incorporates the information provided by the central bank. The results could also be driven by surprisingly large sentiment changes and not necessarily just by incremental changes in the sentiment index. If the results

TABLE 8. Regression Results: New Sentiment Shock

	Sentiment Score	
Explanatory variable	MA(4)	MA(6)
Constant	1.45	1.05
	(1.51)	(0.9)
Lagged sentiment score (SS_{t-1})	1.30***	1.46***
	(0.09)	(0.10)
Lagged sentiment score (SS_{t-2})	−0.32***	−0.47***
	(0.09)	(0.10)
Inflation expectations (CPI_t^{ex})	0.43	0.18
	(1.06)	(0.61)
Lagged inflation expectations (CPI_{t-1}^{ex})	2.69*	0.83
	(1.62)	(1.00)
Lagged inflation expectations (CPI_{t-2}^{ex})	−3.75***	−1.45**
	(1.00)	(0.71)
Summary statistic		
No. observations	175	173
R^2	0.98	0.99
F test	0.00	0.00

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.
Note: Standard errors are in parentheses.

were significant, they would have demonstrated that we have an inefficient market that has not incorporated all available information or that we need to smooth the sentiment index to depict a more accurate sentiment series. We then examine whether the previous results hold after replacing the sentiment index with its four-month moving average and its six-month moving average.[43] Table 8 presents the results corresponding to the altered specification for the sentiment score surprise. We find some significant changes when using the moving averages of the sentiment score in the regression. Namely, the effect of the first sentiment score lag is stronger, while the impact of the second lag is now negative. Also, and more importantly, the effect of inflation expectations is smaller in magnitude.

The estimated impact of the reevaluated sentiment shocks on the stock market is shown in table 9. Comparing these values to those from table 4,

43. We chose these lengths for the moving averages because we found that they are among the shortest moving average periods that minimize the noise of the sentiment index while demonstrating the impact of large movements. We also tried different orders of the moving average, and the results were comparable to earlier findings.

T A B L E 9 . Regression Results Using Moving Averages: Effects on Stock Market

	Sentiment Score	
Explanatory variable	MA(4)	MA(6)
Constant	7.89	8.48
	(9.69)	(9.91)
D08	−17.57	−17.24
	(12.27)	(12.52)
r_t^{US}	21.12**	22.07**
	(8.85)	(8.75)
Monetary surprise	−1.69**	−1.70**
	(0.68)	(0.69)
Monetary surprise $\times$ D08	1.94**	1.87**
	(0.75)	(0.78)
Sentiment surprise	−0.28	−3.62
	(2.56)	(3.44)
Sentiment surprise $\times$ D08	9.06	14.58*
	(5.75)	(7.56)
WTI	8.12***	8.13***
	(2.89)	(3.10)
Copper	11.26**	10.33**
	(4.67)	(4.70)
Summary statistic		
No. observations	166	164
R^2	0.29	0.29
F test	0.00	0.00
Coefficient test (p value)		
Effect of monetary surprises $(\beta_3 + \beta_4)$	0.32	0.38
Effect of sentiment surprises $(\beta_5 + \beta_6)$	0.09	0.11

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.
Note: Standard errors are in parentheses.

we find that different definitions of the sentiment shocks do not qualitatively alter the main results.[44]

We also examine the sum of the coefficient estimates for the second half of the sample. We find that in this period, the monetary policy surprises do not have a statistically significant impact on the stock market, while the moving average of sentiment surprises has a weaker estimated impact on the stock market. This supports earlier findings that after the last financial crisis, equity

44. The use of moving averages clears the noise of the index and reduces its variance while maintaining large movements. Therefore, the increase in the sensitivity of the index could be viewed as a more unambiguous indication of changes in the policy stance.

markets began to react significantly to the most recent sentiment surprises and not necessarily to the history of these surprises.

In terms of the effect of monetary policy surprises on interest rates, the results remain robust.[45] The effect of MPR surprises is positive, statistically significant, and monotonically decreasing from the three-month rate to the five-year rate. The effect on the ten-year bond is positive but not significant. Concerning the sentiment surprises, we find that the magnitude of the coefficients increases but their statistical significance decreases.

RiskAmerica Data

We also conducted the empirical analysis of interest rates using data from RiskAmerica, a Chilean-based financial information and engineering company. RiskAmerica estimates the daily yield curve using dynamic stochastic models. We use this data to estimate the response of the interest rate market on monetary policy surprises.

The results of this analysis are presented in table 10. The effect on interest rates is qualitatively similar to our previous findings. The effect of MPR surprises is positive, significant, and monotonically decreasing from the three-month interest rate to the five-year interest rate, while the effect on the ten-year interest rate is not statistically significant. The effect of the sentiment surprise index is statistically significant only for the three-month and six-month interest rates, consistent with earlier findings.

Sentiment Component Index: Domestic Indicators Only

Insofar as the CBC policy statements discuss economic indicators of other countries, we want to determine whether such discussions drive a significant portion of the results. To evaluate this possibility, we recalibrate the sentiment score of each policy statement while focusing only on discussions about the domestic outlook.[46] As shown in figure 10, the sentiments calculated using only domestic factors follow a very similar pattern to the main measure.

We also evaluate the results using this measure. Our findings indicate that the effect of the news shock on the stock market is still statistically significant at the 5 percent level after accounting for the structural break. The results for

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45. The results are not shown here for reasons of space, but they are available on request.

46. In particular, we omit the sentences that contain the following words: developed, emerging, Europe, European, external, federal, global, globally, Greece, Greek, industrial, international, internationally, internationals, Japan, subprime, U.S., united, and world.

T A B L E 1 0 . **RiskAmerica Data: Effect on Interest Rates**

| | Dependent variable | | | | |
| | Nominal swap rate | | | Nominal CBC bond rate | |
Explanatory variable	3 months	6 months	1 year	5 years	10 years
U.S. rate	0.16	0.01	0.31**	0.05	0.18
	(0.15)	(0.22)	(0.14)	(0.10)	(0.13)
Monetary surprise	0.42***	0.26**	0.21***	0.18***	0.15*
	(0.12)	(0.10)	(0.06)	(0.07)	(0.09)
Monetary surprise × D08	0.39***	0.18*	0.08	−0.05	−0.18*
	(0.14)	(0.11)	(0.07)	(0.07)	(0.11)
Sentiment surprise	0.14*	0.17**	0.06	−0.05	−0.21
	(0.08)	(0.07)	(0.05)	(0.07)	(0.13)
Sentiment surprise × D08	−0.14	−0.24*	−0.02	0.13	0.40**
	(0.16)	(0.13)	(0.11)	(0.12)	(0.19)
WTI	0.16	0.09	0.12	−0.09	−0.31
	(0.32)	(0.21)	(0.16)	(0.18)	(0.33)
Copper	0.03	0.32	0.35	0.77**	0.45
	(0.55)	(0.45)	(0.32)	(0.32)	(0.42)
Chilean EMBI Spread	0.07	−0.05	−0.10	0.01	0.12*
	(0.06)	(0.09)	(0.07)	(0.04)	(0.07)
D08	−0.32	0.32	0.05	1.00	1.62
	(1.24)	(1.17)	(0.86)	(0.98)	(1.37)
Inflation expectations	5.81***	1.77	2.02**	−1.31	−2.12
	(1.62)	(1.39)	(0.99)	(1.29)	(1.41)
Constant	−16.42***	−5.60	−6.10*	2.52	4.91
	(5.09)	(4.48)	(3.15)	(4.16)	(4.62)
Summary statistic					
No. observations	156	156	156	159	158
R^2	0.77	0.56	0.51	0.21	0.11
F test	0.00	0.00	0.00	0.01	0.04

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.
Note: Standard errors are in parentheses.

the bond market also hold. Thus, much of the estimated impact of the statements seems to result from the discussions of domestic information.

Reducing the Number of Hawkish Keywords

The selection of keywords includes more hawkish than dovish terms. This selection may affect the calculation of the sentiment index and thus could potentially bias the estimated impact of surprise sentiments on financial markets. To address this issue, we examine the sentiment index and the corresponding impact on asset prices when we minimize the set of hawkish key terms considered.

FIGURE 10. Full Statement versus Domestic Factors Only

Points
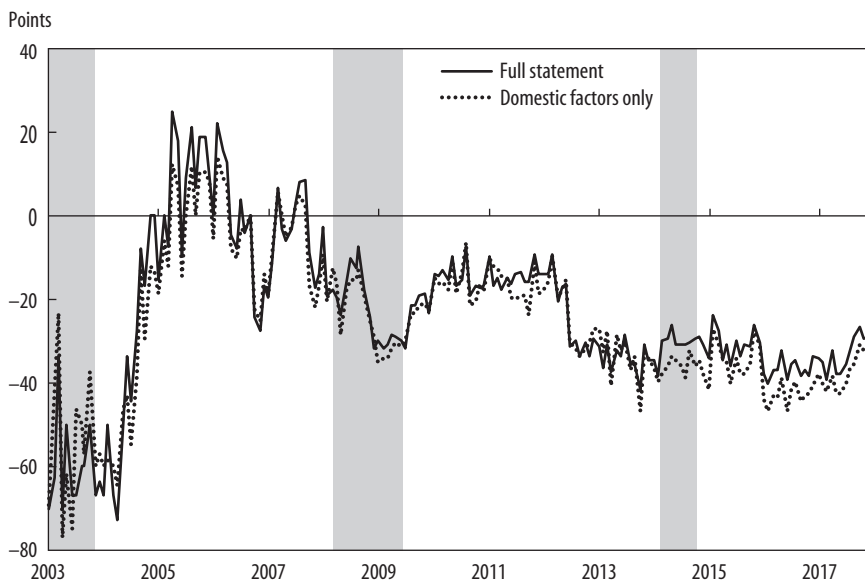
Source: Authors' calculations.

We employ two methods to narrow down the hawkish keyword set. The first is to examine the original set of keywords and choose the terms that receive the most attention in CBC documents. These are the terms that we subjectively consider to be the most related to the inflation target range and Chilean economic growth. Our evaluation resulted in the term set {activity, confidence, copper, employment, financial, growth, indicators, inflation, inflationary}. These terms refer to economic activity, consumer or business confidence, inflation, and copper.

The second method of reducing the number of hawkish keywords involves a more objective approach. We examined the frequency with which each term was discussed in all the monetary policy releases and chose the five most frequently occurring hawkish terms. Thus the number of hawkish keys matches the number of dovish keys, while emphasizing the most highlighted hawkish keys. The resulting subset of keywords is {inflation, prices, growth, financial, output}. The two recalibrated sentiment indexes are compared to

FIGURE 11.   Comparison of Sentiment Indexes: Different Sets of Hawkish Keywords

Points
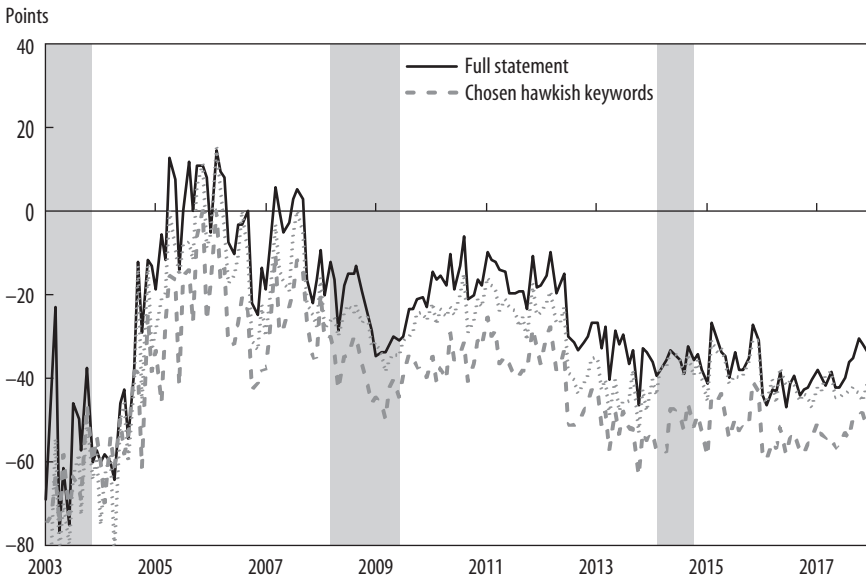
Source: Authors' calculations.

the original index in figure 11.[47] From 2003 to 2005, there was a good amount of overlap among the sentiments. Thereafter, the sentiment based on chosen keywords was systematically lower, although it followed very similar fluctuations. The other two indexes, on the other hand, remained close to one another. The only difference was that the original index is systematically higher, thereby reflecting the larger number of hawkish keywords that it incorporates.

To examine how the revised sentiment indexes affect asset prices, we compare the original index to those derived using chosen hawkish keywords and frequency-based hawkish keywords. The results are shown in table 11. Consistent with earlier findings, we observe that sentiment surprises in the second part of our sample have a positive and statistically significant impact on Chilean equity prices. In contrast, monetary policy surprises have significant

47. The descriptive statistics of these sentiment indexes are available upon request.

T A B L E 1 1 .   **Effects on the Stock Market: Subsets of Hawkish Keywords**

Explanatory variable	All hawkish keywords	Chosen hawkish keywords	Frequency-based hawkish keywords
Constant	11.22	11.53	11.7
	(9.47)	(9.55)	(9.52)
D08	−19.76	−18.86	−19.57
	(12.10)	(12.09)	(12.23)
r_t^{US}	21.97**	22.53**	23.80***
	(9.03)	(9.42)	(8.63)
Monetary surprise	−1.69**	−1.67**	−1.64**
	(0.72)	(0.66)	(0.69)
Monetary surprise $\times$ D08	2.05**	1.96**	1.92**
	(0.82)	(0.75)	(0.79)
Sentiment surprise	−0.41	−0.33	−0.30
	(0.64)	(0.77)	(0.64)
Sentiment surprise $\times$ D08	3.90**	4.21***	4.25**
	(1.57)	(1.54)	(1.84)
WTI	8.63***	8.60***	8.25***
	(2.98)	(2.82)	(2.92)
Copper	10.61**	10.38**	10.75**
	(4.49)	(4.51)	(4.45)
Summary statistic			
No. observations	169	169	169
R^2	0.30	0.31	0.31
F test	0.00	0.00	0.00
Coefficient test (p value)			
Effect of monetary surprises ($\beta_3 + \beta_4$)	0.20	0.27	0.30
Effect of sentiment surprises ($\beta_5 + \beta_6$)	0.02	0.00	0.02

**p < 0.05; ***p < 0.01.
Note: Standard errors are in parentheses.

effects on the prices of these financial assets for the first half of the period under consideration. These results indicate that the larger size of the set of hawkish key terms does not drive the results on the evaluated impact of surprise sentiments on equity prices.

We also evaluated whether the estimated impact of the fixed-income markets changed. We find that the earlier results hold. The impact of policy rates is significant but monotonically decreasing, while sentiment shocks do not seem to have any lasting impact on the bond market.

Noncontemporaneous Sentiment Shock

To examine the robustness of the findings from our VAR analysis, we also estimated a VAR that uses the component of the sentiment score not explained

by the contemporaneous effect of the MPR. We conducted this evaluation by running a regression between the sentiment score and the MPR and then using the residuals of this regression as the noncontemporaneous version of the sentiment score. We refer to this as the NC sentiment score. Although the coefficient of monetary policy is highly significant (3.23***, with a standard error of 3.08), the R^2 of the regression is only 0.10. This result supports the claim made in prior work and is in line with the original VAR assumptions.
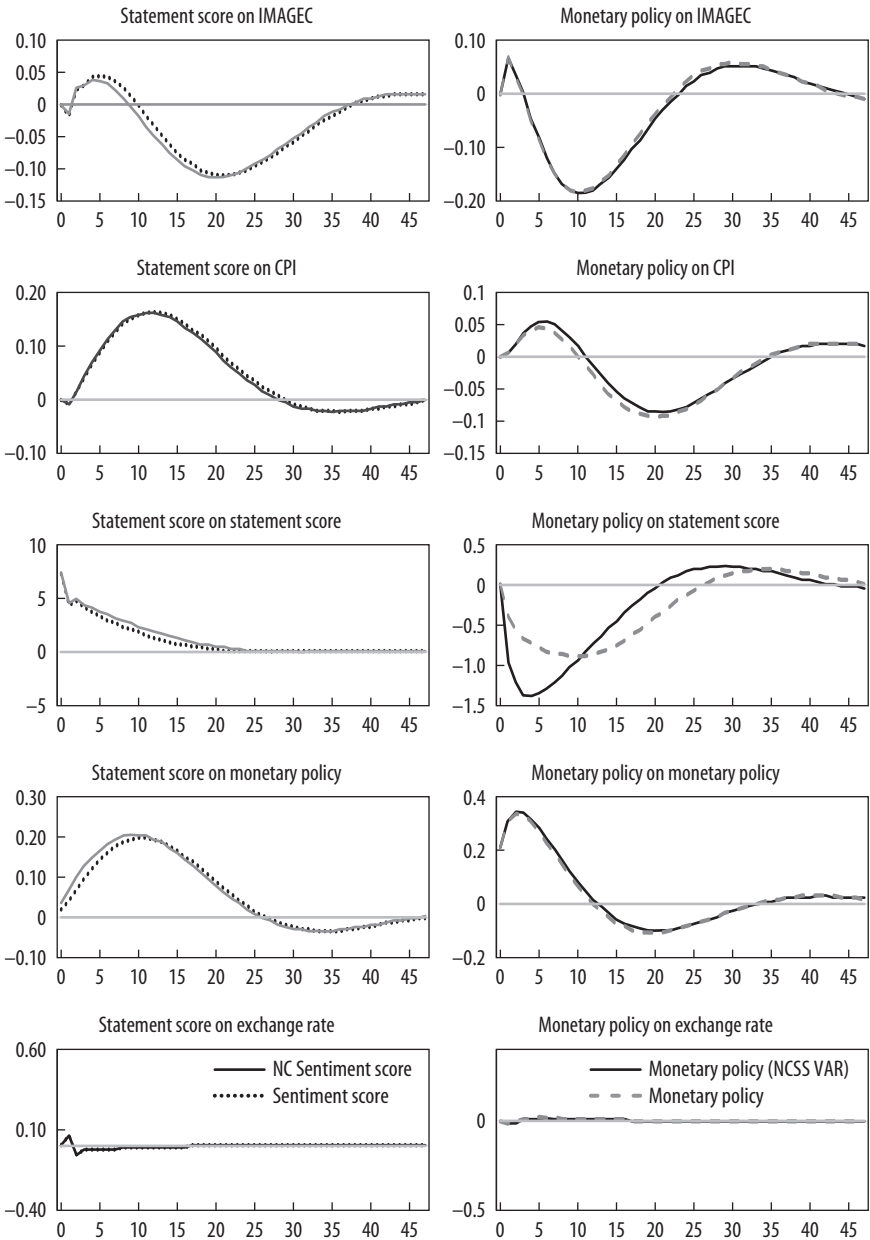
The results of the impulse response functions (IRFs) show that this new specification has virtually the same effect on all variables as the original sentiment score (see figure 12). The main difference is in the effect of the monetary policy shocks on the sentiment shock. In the original specification, the effect of monetary policy is stronger, but it lasts for a shorter period. This result, therefore, does not change the qualitative assessment of the initial VAR.

To study the effect of monetary policy on the financial market while using the previous VAR as a base model, we ran several VARs using different financial variables ordered last. This is the same methodology used in Lucca and Trebbi (2011), and we find it very intuitive because it can isolate the monetary policy effect on the real sector of the economy regardless of the financial instruments included. It also allows us to compare the base VAR with other estimations in the literature.

Figure 13 shows the IRFs of a sentiment shock and a monetary policy shock on the stock market. We ran the VAR covering two different periods of the monthly data. The first covers the full sample, which starts in January 2003 and ends in December 2017, while the second version begins in August 2008 and ends in December 2017. This is a simple way to analyze the structural change found in the OLS regression presented earlier. The results show that the stock market response to a sentiment surprise is highly volatile both in the full sample and in 2008–17, although the effect seems to be stronger in 2008–17, in line with the evidence previously presented. These results are not significant, however, along with the estimated impact of MPR shocks. Nevertheless, the effect is negative for the full sample period and moves markedly to the positive side when we consider only the second half. This shift is similar to what happens in the main regression. Moreover, the regression analysis was based on daily returns, while the VAR evaluated monthly aggregated returns. The results thus indicate that although the daily returns react significantly to monetary and sentiment shocks, the impact is not necessarily long-lasting.
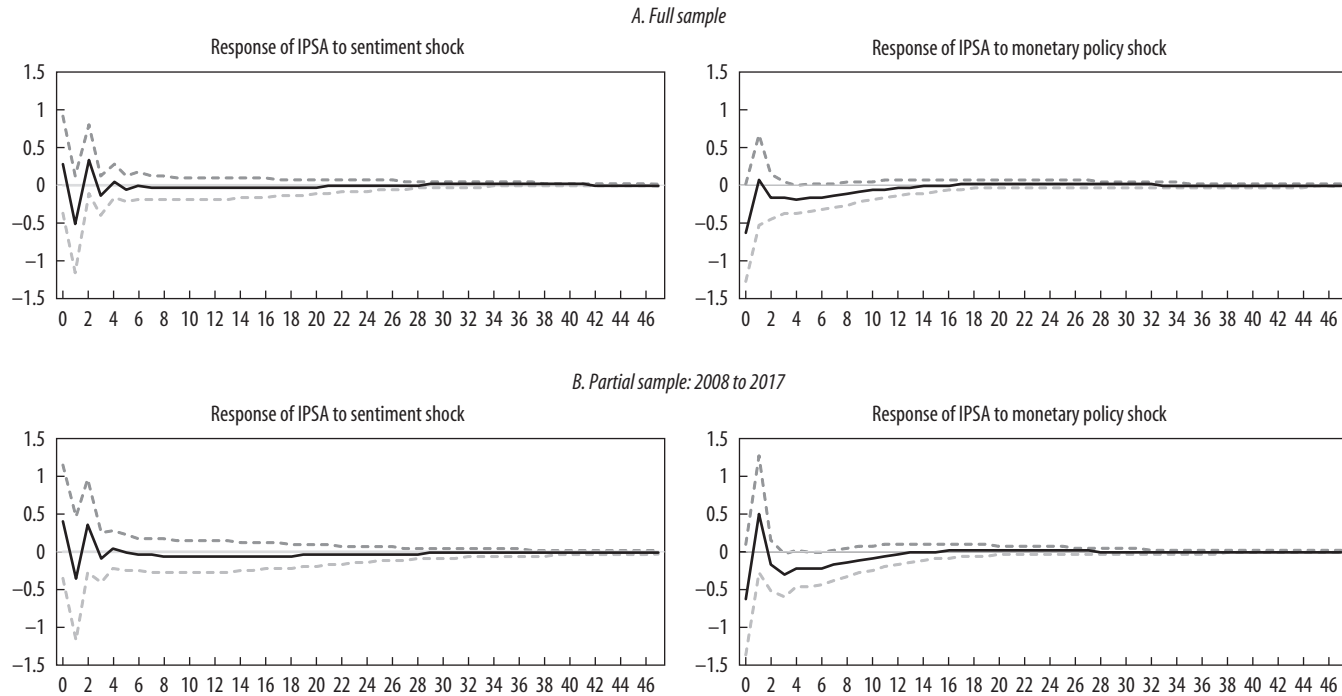
With regard to the yield curve, the IRF results support the results obtained from the baseline regressions, as shown in figure 14. In terms of the sentiment surprise, the yields react positively, but decreasing in terms of maturity.

FIGURE 12. VAR Results: Impulse Response Functions

Statement score on IMAGEC

Monetary policy on IMAGEC

Statement score on CPI

Monetary policy on CPI

Statement score on statement score

Monetary policy on statement score

Statement score on monetary policy

Monetary policy on monetary policy

Statement score on exchange rate

— NC Sentiment score
········ Sentiment score

Monetary policy on exchange rate

— Monetary policy (NCSS VAR)
- - - Monetary policy

Source: Authors' calculations.

FIGURE 13. VAR Results: Stock Market Impulse Response Functions

A. Full sample

Response of IPSA to sentiment shock

Response of IPSA to monetary policy shock

B. Partial sample: 2008 to 2017

Response of IPSA to sentiment shock

Response of IPSA to monetary policy shock

Source: Authors' calculations.

Note: The shock is identified in a recursive VAR with the base variables ordered as follows: exchange rate, activity, inflation, sentiment score, MPR, and stock market return. Each VAR also includes an exogenous sector with the following variables: WTI price, copper price, and U.S. stock market. Full sample covers the period between January 2003 and December 2017. Dotted lines denote two standard error confidence bands.

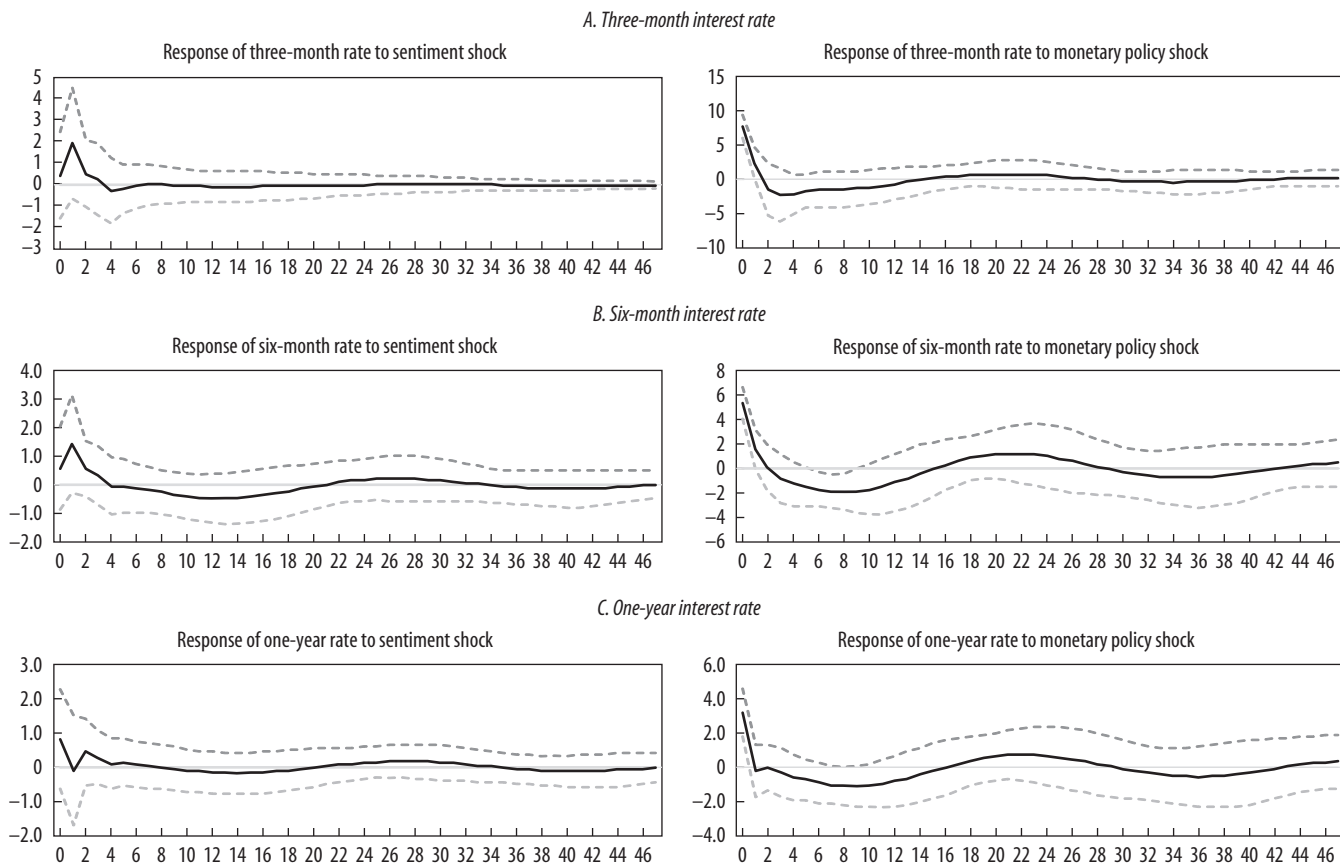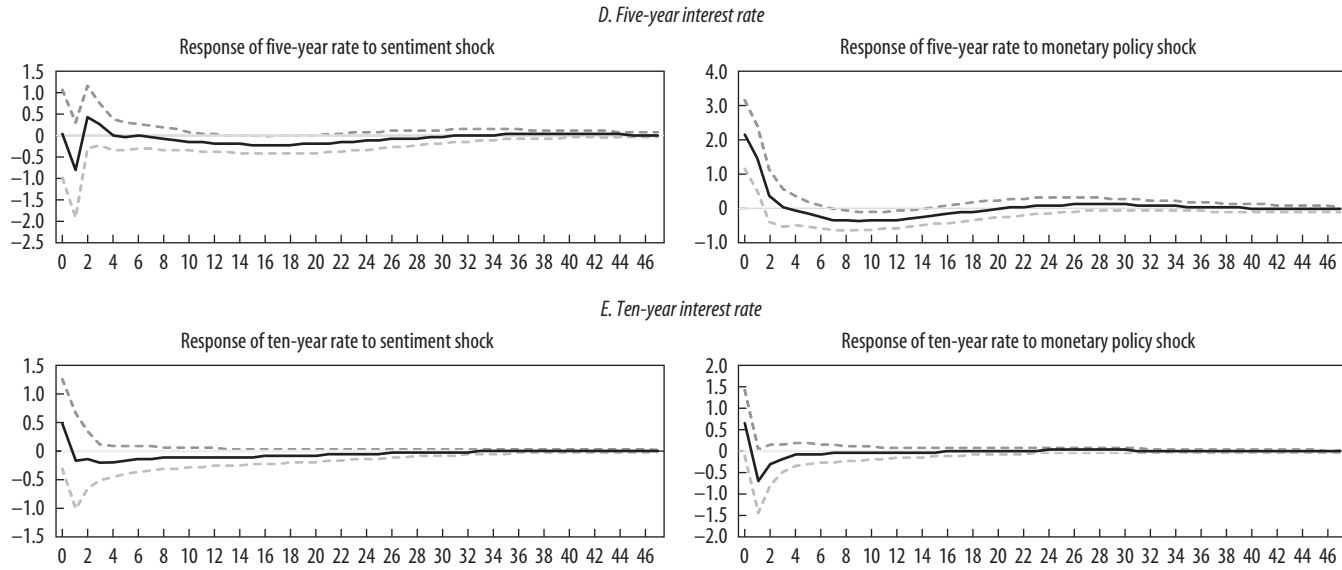**F I G U R E   1 4 .   VAR Results: Interest Rate Impulse Response Functions**

A. Three-month interest rate

Response of three-month rate to sentiment shock

Response of three-month rate to monetary policy shock

B. Six-month interest rate

Response of six-month rate to sentiment shock

Response of six-month rate to monetary policy shock

C. One-year interest rate

Response of one-year rate to sentiment shock

Response of one-year rate to monetary policy shock

FIGURE 14. VAR Results: Interest Rate Impulse Response Functions *(Continued)*

D. Five-year interest rate

Response of five-year rate to sentiment shock

Response of five-year rate to monetary policy shock

E. Ten-year interest rate

Response of ten-year rate to sentiment shock

Response of ten-year rate to monetary policy shock

Source: Authors' calculations.

Notes: The shock is identified in a recursive VAR with the base variables ordered as follows: exchange rate, activity, inflation, sentiment score, and MPR. Each impulse response corresponds to a different VAR model, which, in addition to the variables of the base VAR, includes a different yield ordered last. Dotted lines denote two standard error confidence bands.

Moreover, these results are not significant. These results are similar to Lucca and Trebbi (2011), as well as Hansen and McMahon (2016), who analyze the impact of the economic component of the press releases. In terms of the monetary policy surprises, the results are the same as the literature and our base regression. We find that they are positive, significant, and decreasing over long maturity periods.

Conclusion

In this paper, we examine the Central Bank of Chile's monetary policy communication strategy by studying the information contained in the releases using semi-automated content analysis. Using this methodology, we build an index that tracks the sentiment of each monetary policy press release, which we use to analyze the predictability and effectiveness of monetary policy. When we examine predictability, we refer to whether the press releases contain enough information to anticipate changes in the monetary policy rate; the efficacy, on the other hand, is related to whether the information contained in the press releases can create news that affects the financial market.

We follow two main strands of literature. First, we follow the literature that studies the effect of monetary policy on the financial markets. This vast literature includes Cook and Hahn (1989), Kuttner (2001), and Bernanke and Kuttner (2005). The second strand of literature explores central bank communication. A technical improvement of this literature is the use of linguistic analysis tools that help transform a text document into a more quantitative format. The novelty of this study is that it examines the surprises in MPR adjustments and policy meeting press releases in a historically stable small open economy.

Our findings indicate that monetary policy is highly predictable. A simple cross-correlogram shows that the sentiment score leads the MPR by about twelve months. This is later supported by a VAR showing that the MPR responds to sentiment score surprises with a lag of about a year. In terms of effectiveness, we find that before the financial crisis, the stock market reacted mainly to surprises in the MPR, whereas after the financial crisis, the stock market responded mostly to shocks in the sentiment score index. In terms of the effect on interest rates, the results indicate that an MPR surprise is positive, statistically significant, and monotonically decreasing in the length of the instrument from three months to five years, while the information

revealed in the sentiment score index appears to affect only in the short end of the yield curve before 2008.

The small-scale VAR with an exogenous sector is also used to assess the impact of the MPR and the sentiment score on the real economy. The results show that the effects of the sentiment score on inflation and activity are softer, longer-lasting, and delayed compared to those of the MPR. However, the results of this small-scale VAR are not statistically significant.

According to the theory, the fact that the central bank has a predictable and effective monetary policy (in terms of altering market expectations) means that it has a low noise-to-signal ratio and high credibility. As Bassetto (2019) highlights, forward guidance and credibility can become an effective monetary policy combination through the alignment of public expectations with the central bank's goal. One of the key aspects of the implementation of forward guidance is that it should not decrease the credibility of the central bank. Our findings contribute to these discussions by demonstrating that the press releases not only relay meaningful information but also help make monetary policy more predictable. These policy documents thus boost the predictability of policy and solidify the central bank's credibility by demonstrating that policy decisions depend on the current and projected state of economic indicators, especially those related to inflation.

Given the influence of policy press releases on equity markets, policy-makers should take caution in how they prepare these documents. They may well use these documents to affect the financial markets and guide inflation toward the target range. Therefore, even when the MPR is stable, such as periods when the effective lower bound is binding, policymakers should use the monetary policy press releases as an instrument for meeting their policy objectives. Much more work is needed to determine the optimal way to prepare these policy documents and to evaluate their impact on finance and the real economy.

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